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RESERVE

INSTRUCTION MANUAL

EMR 4150-02
SUBCARRIER DISCRIMINATOR
(Rev. B)

SANGAMO WESTON
Schlumberger
EMR TELEMETRY

ME-7626

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TABLE OF CONTENTS

SECTION			PAGE
1	GENERAL DESCRIPTION		1 - 1
	1.1	Introduction	1 - 1
	1.2	Physical Description	1 - 1
	1.3	Functional Description	1 - 1
	1.4	Typical System Application	1 - 4
2	SPECIFICATIONS		2 - 1
	2.1	General	2 - 1
	2.2	Electrical Specifications	2 - 1
	2.3	Mechanical Specifications	2 - 3
	2.4	Environmental Specifications	2 - 4
3	INSTALLATION AND OPERATION		3 - 1
	3.1	Installation	3 - 1
	3.2	Operation	3 - 1
		3.2.1 Front Panel Controls, Indicators and Test Jacks	3 - 1
		3.2.2 Operational Adjustments	3 - 1
		3.2.2.1 Balance Adjustment .	3 - 5
		3.2.2.2 Bandedge Output Voltage Adjustment . . .	3 - 6
4.	THEORY OF OPERATION		4 - 1
	4.1	General	4 - 1
	4.2	Model 4151 Channel Selector	4 - 1
		4.2.1 General	4 - 1
		4.2.2 Input Amplifier	4 - 1
		4.2.3 Bandpass Input Filter (BPIF)	4 - 1
		4.2.4 Differential Amplifier, Limiter, and Schmitt Trigger	4 - 3
		4.2.5 Tape-Speed Compensation (TSC) and Temperature Compensation (TC) Circuit	4 - 3
		4.2.6 FM Detector and Driver	4 - 4
		4.2.7 Voltage Switch and Deviation Sensitivity Components	4 - 5
	4.3	Model 4157 LPOF and Output Amplifier . . .	4 - 5
		4.3.1 General	4 - 5
		4.3.2 Low-Pass Output Filter, Filter Amplifier, and Voltage Limiter .	4 - 6

TABLE OF CONTENTS

SECTION			PAGE
	4.3.3	Output Amplifier and Current Limiters	4 - 7
	4.4	Signal Loss Circuits	4 - 7
	4.5	Power Supply Regulator	4 - 7
5	MAINTENANCE		5 - 1
	5.1	General	5 - 1
	5.2	Troubleshooting	5 - 1
	5.2.1	Inspection	5 - 1
	5.2.2	Power Supply Check	5 - 2
	5.2.3	Circuit Waveforms	5 - 2
	5.2.4	Transistor Voltage Measurements .	5 - 3
	5.3	Adjustments	5 - 3
	5.3.1	Symmetry Adjustment	5 - 3
	5.3.2	Low-Pass Output Filter Offset Adjustment	5 - 4
	5.3.3	Bandedge Meter Zero Adjustment .	5 - 4
	5.3.4	Bandedge Meter Sensitivity Adjustment	5 - 5
6	REPLACEABLE PARTS LIST AND RECOMMENDED SPARES LIST		6 - 1
	6.1	General	6 - 1
	6.2	Replaceable Parts Lists	6 - 1
	6.3	Recommended Spares Lists	6 - 1
	6.4	Provisioning Considerations	6 - 2
	6.5	Ordering Instructions	6 - 3

LIST OF ILLUSTRATIONS

FIGURE		PAGE
1 - 1	EMR 4150 Subcarrier Discriminator Simplified Block Diagram	1 - 3
1 - 2	Typical System Application	1 - 5
3 - 1	EMR 4150-02 External Electrical Connections	3 - 2
3 - 2	EMR 4150-02 Front Panel Controls, Indicators, and Test Jacks	3 - 3
4 - 1	EMR 4150-02 Subcarrier Discriminator Detailed Block Diagram	4 - 2
5 - 1	Top Assembly Diagram, EMR 4150-02	5 - 15
5 - 2	Front Panel Assembly Diagram	5 - 16
5 - 3	Chassis Assembly Diagram	5 - 17
5 - 4	Interconnect Printed-Wiring Card Assembly Diagram	5 - 18
5 - 5	(1 of 2). Interconnect Printed-Wiring Card Wiring Diagram	5 - 19
5 - 5	(2 of 2). Interconnect Printed-Wiring Card Wiring Diagram	5 - 20
5 - 6	Channel Selector Printed-Wiring Card Assembly Diagram, Model 4151	5 - 21
5 - 7	Channel Selector Printed-Wiring Card Schematic Diagram, Model 4151	5 - 22
5 - 8	Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Assembly Diagram, Models 4157-05/-06 (frequencies>500 Hz), 4157-02, and 4157-03	5 - 23
5 - 9	Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Schematic Diagram, Models 4157-05/-06 (frequencies>500 Hz), 4157-02, and 4157-03	5 - 24
5 - 10	Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Assembly Diagram, Models 4157-05 and 4157-06 (frequencies≤500 Hz)	5 - 25
5 - 11	Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Schematic Diagram, Models 4157-05 and 4157-06 (frequencies ≤500 Hz)	5 - 26
5 - 12	Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Assembly Diagram, Model 4157-07	5 - 27
5 - 13	Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Schematic Diagram, Model 4157-07	5 - 28
5 - 14	Power Supply/Regulator Printed-Wiring Card Assembly Diagram	5 - 29
5 - 15	Power Supply/Regulator Printed-Wiring Card Schematic Diagram	5 - 30
5 - 16	Wiring Diagram, EMR 4150-02	5 - 31
5 - 17	Signal Loss Printed-Wiring Card Assembly Diagram (Optional)	5 - 32
5 - 18	Signal Loss Printed-Wiring Card Schematic Diagram	5 - 33
6 - 1	Top Assembly Variable Chart and Parts Information	6 - 4

LIST OF TABLES

TABLE NO.		PAGE
2-1	Harmonic Distortion, Noise, and Nonlinearity Specifications. . .	2-5
2-2	EMR 4150-02 Subcarrier Discriminator Part Number Identification.	2-6
2-3	Model 4151 Channel Selector Part Number Identification.	2-8
2-4	Model 4157 LPOF and Output Amplifier Part Number Identification.	2-9
2-5	IRIG and EMR Constant-Bandwidth Telemetry Channels	2-10
2-6	IRIG Proportional-Bandwidth Telemetry Channels	2-12
2-7	EMR 12-Channel Constant-Bandwidth Instrumentation Systems. . . .	2-13
3-1	Function of Front Panel Controls, Indicators and Test Jacks. . .	3-4
5-1	EMR 4150-02 Subcarrier Discriminator, Circuit Waveforms.	5-6
5-2	Model 4151 Channel Selector Transistor Voltages	5-11
5-3	Model 4157-02/03/-05/-06 LPOF and Output Amplifier Card Component Voltages	5-12
5-4	Model 4157-07 LPOF and Output Amplifier Card Component Voltages	5-13
5-5	Assembly No. 15807 Power Supply Regulator Assembly Transistor Voltages	5-14
6-1	EMR 4150-02 Parts List	6-5
6-2	EMR Parts List (Discr, Assy, Subcarrier).	6-7
6-17	EMR 4150-02 Parts List	6-45
6-18	EMR 4150-02 Parts List	6-47
6-19	EMR 4150-02 Recommended Spares List	6-48
6-20	EMR Model 4151 Channel Selector Recommended Spares List	6-49
6-21	EMR Models 4157-02 and 4157-03 Low Pass Output Filters . . . . Recommended Spares List (Including Models 4157-05 and 4157-06 for frequencies> 500 Hz)	6-50
6-22	EMR Models 4157-05 and 4157-06 Low-Pass Output Filter Recommended Spares List (for frequencies>500 Hz).	6-51
6-23	EMR Model 4157-07 Low-Pass Output Filter Recommended Spares List	6-52
6-24	EMR Signal Loss Card Recommended Spares List	6-53
6-25	Customer Provisioning Questionnaire	6-54

SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual contains information describing the EMR 4150-02 Subcarrier Discriminator. Included in this information are a physical and a functional description, typical system application description, specifications, installation and operation procedures, theory of operation, maintenance data, and replaceable parts lists.

The 4150 is a high performance subcarrier discriminator designed to separate and demodulate channels of an FM multiplex system. The 4150 employs pulse averaging detection and has positive sense operation (increasing subcarrier frequency results in positive-going output voltage).

1.2 PHYSICAL DESCRIPTION

The EMR 4150-02 Subcarrier Discriminator is a modular unit designed for mounting in an EMR Model 4005 Rack Adapter. Overall dimensions of the 4150 are listed under the mechanical specifications contained in Section 2 of this manual. Major assemblies of the 4150 include a Model 4151 Channel Selector card, a Model 4157 Low-Pass Output Filter (LPOF) and Output Amplifier card, an interconnect card, a power supply regulator card, and a chassis assembly. If the signal loss option is included, a signal loss card is installed on the channel selector card. Locations for the card assemblies within the chassis assembly are illustrated in Figure 5-1 by item numbers as follows:

ITEM NO.	NAME
6	Power Supply/Regulator Card
7	Low-Pass Output Filter and Output Amplifier Card
8	Channel Selector Card
20	Optional Signal Loss Card

1.3 FUNCTIONAL DESCRIPTION (REF. FIGURE 1-1)

The EMR 4150-02 Subcarrier Discriminator is an FM discriminator designed to demodulate a single subcarrier input or a predetermined channel of an FM subcarrier multiplex. The input information may be in either real-time or prerecorded form. The detected intelligence data is provided at the output of the 4150 in the form of a varying analog voltage which can then be used for further processing and display. Operation on any bandedge frequency between

300 Hz and 2 MHz with deviations from ±2.5% to ±45% is enabled through the use of interchangeable channel selector cards. Output data cutoff frequencies between 3 Hz and 450 KHz and various data response and rolloff characteristics are provided by interchangeable output filter cards. A front panel meter provides an indication of the relative position of the subcarrier frequency within the band. Front panel controls are provided for adjusting the data output voltage for bandedge-to-bandedge deviation in the subcarrier channel, for selecting one of two cutoff frequencies when using an output filter card with switchable characteristics, and for zeroing the discriminator output with a center frequency applied to the unit. The subcarrier input is coupled through an input amplifier to the bandpass input filter (BPIF) on the Model 4151 Channel Selector card. Several configurations of the Model 4151 Channel Selector are available with the primary difference being in the type of BPIF. For FM multiplex applications, either 4-pole pair or 2-pole pair linear phase filters are available; whereas for single channel applications, channel selector cards are available without input filters. The subcarrier output of the BPIF, or the input amplifier in the case of the single channel applications, is amplified and limiter by the limiter circuit. The resultant square-wave subcarrier output of the limiter is applied to a pulse-averaging FM detector circuit where deviations from the established subcarrier center frequency are detected using two quarter wave detectors. When the 4150 is being used in a playback system (demodulating prerecorded data), an input is applied to a tape-speed compensation network and provides an input to the FM detector which compensates for erroneous modulation of the subcarrier input resulting from tape-speed variations.

The FM detector output is filtered by the low-pass output filter before being applied to the subcarrier deviation meter (% B.E. meter) and the bandedge voltage control (BEV potentiometer). The output voltage is limited to 125 percent of the normal bandedge voltage by the bandedge voltage limiter before being applied to the output amplifier. The output amplifier is a wideband, medium power, operational amplifier that is designed to provide up to 10 volts at 100 milliamperes over the bandwidth of dc to 450 KHz. The output amplifier is capable of driving any value of capacity, without oscillating, that does not exceed its rated current.

The self-contained regulated power supply provides ±18v dc power for operation of the 4150 circuits.

An optional signal loss detector is available in the 4150. When included, this circuit operates directly at the BPIF output to detect a loss of signal. The threshold of a signal loss condition is adjustable from 2 millivolts to 50 millivolts. When the input signal drops below the established threshold, a front panel indicator is illuminated and the LPOF output is clamped to a ground level. This results in clamping the unit data output to a level of 0 volt ± 1 volt.

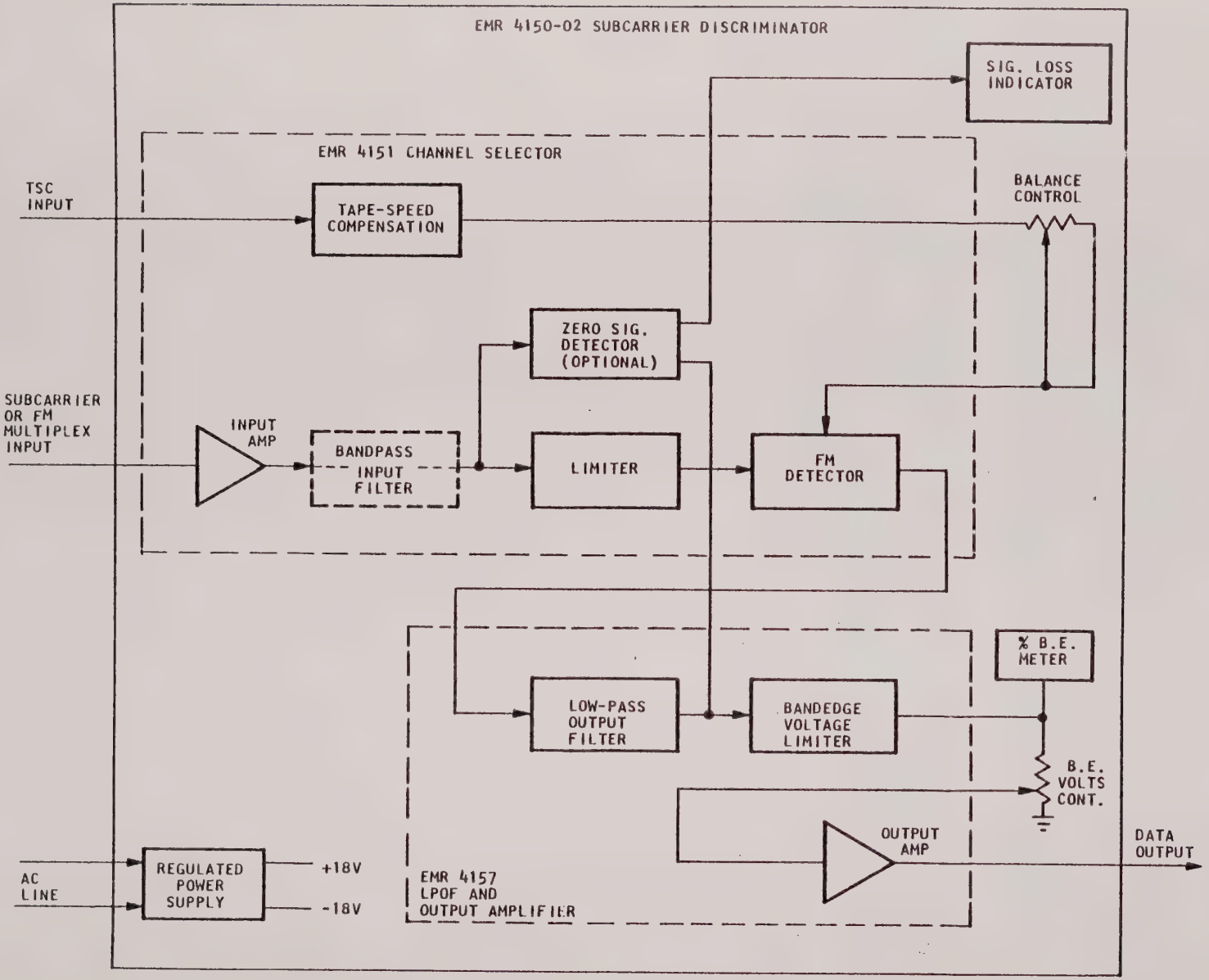


Figure 1-1. EMR 4150 Subcarrier Discriminator Simplified Block Diagram

1.4 TYPICAL SYSTEM APPLICATION

The EMR 4150-02 Subcarrier Discriminator demodulates a single subcarrier input or a predetermined channel contained in an FM subcarrier multiplex system. The input information may be in real-time or prerecorded form. The resultant output of the 4150 is in the form of a varying analog voltage representing the detected intelligence data. The analog output voltage is then used for further processing and display. A typical system configuration is shown in Figure 1-2.

When using the 4150 in a playback system, in which the subcarrier multiplex is prerecorded, the use of a reference discriminator such as the EMR 4130 Discriminator is recommended. The reference discriminator provides a tape-speed compensation (TSC) error signal input to the 4150. This signal compensates for any tape speed variations which occur during the recording or playback of the magnetic tape.

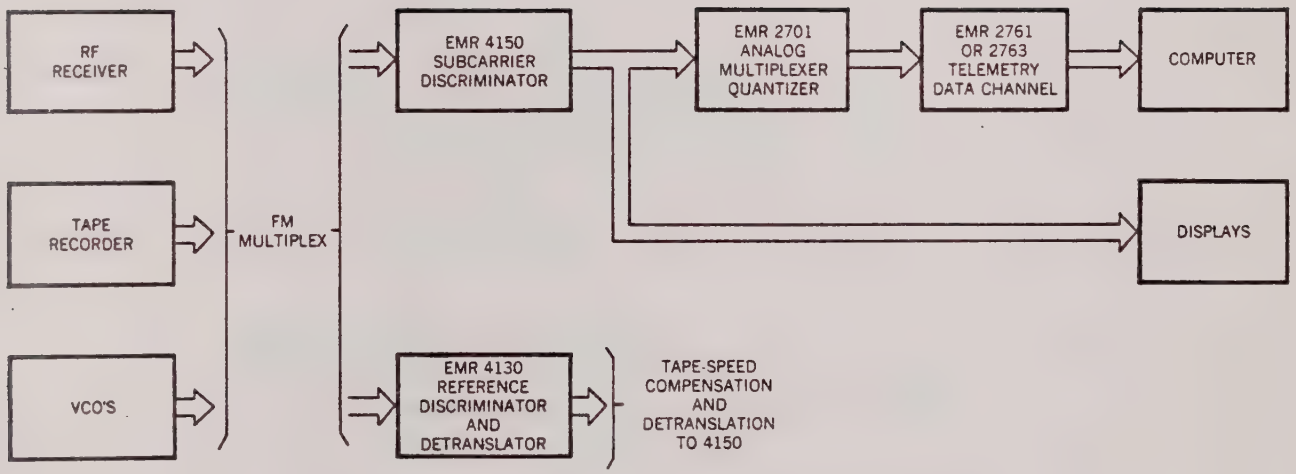


Figure 1-2. Typical System Application

SECTION 2

SPECIFICATIONS

2.1 GENERAL

This section contains the electrical and mechanical specifications for the EMR 4150-02 Subcarrier Discriminator. These specifications are outlined in paragraphs 2.1 and 2.2. Also included in this section is a list of the integral components of the 4150 discriminator and part number identification for these components. This information is provided in Tables 2-2, 2-3, and 2-4. Standard EMR and IRIG FM subcarrier channels and typical systems are defined in tables 2-5, 2-6, and 2-7.

2.2 ELECTRICAL SPECIFICATIONS

a. Subcarrier Channel Center Frequencies: Any bandedge frequency between 300 Hz and 2 MHz as established by the Model 4151 Channel Selector. This frequency is indicated on the front panel of the unit. Several versions of the Model 4151 are available. These units are described in Table 2-3.

b. Center Frequency Deviations: ±2.5% to ±45% of center frequency for no bandpass input filter (BPIF) and for 2-pole pair BPIF; ±2.5% to ±30% for 4-pole pair BPIF.

c. Input Impedance: Not less than 100k ohms shunted by not more than 40 picofarads.

d. Dynamic Input Signal Range: 2 millivolts RMS through 5 volts RMS at center frequencies not more than 300 KHz. 5 millivolts RMS through 5 volts RMS at center frequencies of 300 KHz or greater.

e. Amplitude Modulation Rejection: The output transient is not more than 1.0% of full bandwidth for a 20 db step change (occurring anywhere within the input signal range) in subcarrier amplitude at center frequency with a modulation index of 5.

f. Tape-Speed Compensation: Tape-speed improvement for wow and flutter variations as great as ±3%, up to channel cut-off frequency, is no less than 33 db at a modulation index of 5 and no less than 23 db at a modulation index of 2.

g. Data Cut-off Frequencies: Any frequency from 3 Hz through 450 KHz as determined by the Model 4157 Output Filter. This frequency is indicated on the front panel. When the Model 4157-07 is included, two cut-off frequencies are supplied. Both frequencies are identified on the front panel. A front panel switch is used to select the desired frequency.

h. Output Filter Response Characteristics:

1. At data cutoff frequencies between 3 Hz and 450 kHz:

5-pole - asymptotic rolloff, 30 dB octave, with either constant amplitude (CA) or constant delay (CD) characteristic.

7-pole - asymptotic rolloff, 30db per octave, with either CA or CD characteristic.

2. At data cutoff frequencies between 3 Hz and 20 kHz:

5-pole - asymptotic rolloff, 30 dB per octave, with any two data cutoff frequencies and any combination of CA/CD, CA/CA, or CD/CD characteristics.

i. Harmonic Distortion: (See Table 2-1)

j. Noise: (See Table 2-1)

k. Nonlinearity: (See Table 2-1)

l. Output Voltage and Current: Adjustable between ±0.1 and ±10.5 volts for normal operation. The output voltage is limited to a maximum of 155% of full scale regardless of the bandedge volts control. Output current capability is 100 milliamperes, limited to a maximum of ±130 milliamperes. A short circuit output will not damage the unit.

m. Output Polarity: Output becomes more positive with an increase in input frequency.

n. Output Impedance: Not greater than 0.2 ohm at dc; not greater than 1 ohm to 10 KHz; not greater than 3 ohms to 100 KHz; not greater than 5 ohms to 450 KHz.

o. Output Capacitive Loading Capability: Any capacitive load, without oscillations, where rated output current is not exceeded.

p. Output Zero Stability:

1. Center frequencies less than 10 KHz: Zero drift is ±0.03% of full bandwidth (FBW) plus ±0.05% of center frequency (CF) in 15 hours after a 30-minute warmup. Temperature coefficient of zero drift is ±0.005% of FBW plus ±0.005% of center frequency/°C average.

2. Center frequencies equal to or greater than 10 KHz: Zero drift is ±0.03% of FBW plus ±0.01% of center frequency in 15 hours after a 30-minute warmup. Temperature coefficient of zero drift is ±0.005% of FBW plus ±0.0025% of CF/°C average.

q. Deviation Sensitivity Instability: Not greater than ±0.05% in 15 hours after a 30-minute warmup and ambient temperature variation of less than ±3°C.

r. Line Voltage Sensitivity: A 10-volt change of line voltage anywhere between 105 to 132 volts RMS causes a change of not more than 0.1% of full bandwidth in output zero or sensitivity.

s. Power Requirement: 105 to 132V RMS, 47 to 65 Hz, single phase (24 watts at full load); 105 to 132V RMS, 360 to 440 Hz; 230V ±10%, 47 to 65 Hz. (See Table 2-2 for power input identification).

2.3 MECHANICAL SPECIFICATIONS

a. Panel Size: 5-1/4 inches (13.3 Cm) high by one modular width (1-7/32 inches; 3.10 Cm).

b. Depth: 16-3/4 inches (42.5 Cm) to rear of unit (excluding projections from front panel.)

c. Weight: Net, 3.4 pounds (1.55 kg); shipping, 5 pounds (2.27 kg).

d. Mounting: The 4150 is designed for mounting in an EMR Model 4005 Rack Adapter. Up to fourteen 4150 discriminators may be mounted in a single rack adapter. The rack adapter is intended for installation in a standard 19-inch equipment rack.

e. Panel Finish: Gray (26492B) semigloss baking enamel color and black lettering combination is standard. Special paints also are available.

2.4 ENVIRONMENTAL SPECIFICATIONS

a. Operating Temperature: +10°C to +50°C

b. Storage Temperature: −50°C to +85°C

c. Relative Humidity: 5% to 95%

d. Altitude: Up to 15,000 feet

e. Shock-Nonoperating: Per MIL-STD-810A, Method 516, Procedure III

f. Vibration-Nonoperating: Per MIL-STD-810A, Method 510, Equipment Class 6, Figure 514-6, Curve A.

Output Specification	Center Frequency: 300 Hz → 300 KHz	Center Frequency: 300 KHz → 2 MHz	MI	Deviation	Comments
Harmonic Distortion	⊳ 1.0% ⊳ 0.5%	⊳ 1.0% ⊳ 0.5%	2 ⊲ 5	------ ------	At any data frequency up to the channel cut-off frequency using a 4-pole pair linear-phase bandpass input filter.
Noise	⊳ 20 mv RMS or 50 mv p-p at 20V p-p output level. ⊳ 8 mv RMS or 30 mv p-p at 20V p-p output level.	⊳ 20 mv RMS or 50 mv p-p at 20V p-p output level. ⊳ 8 mv RMS or 30 mv p-p at 20V p-p output level.	2 5	------ -------	Anywhere within the input signal range when using a 5-pole constant delay low-pass output filter.
Nonlinearity	⊳ 0.03% of full bandwidth, best straight line. ⊳ 0.1% of full bandwidth, best straight line.	⊳ 0.1% of full bandwidth, best straight line. ⊳ 0.3% of full bandwidth, best straight line.		⊳ ±15% ±15% to ±45%	

⊳ Not greater than. ⊲ Not less than

Table 2-2. EMR 4150-02 Subcarrier Discriminator Part Number Identification

	a	b	c	d	e	f	g	h	i	j	k	l	m
EMR 4150-	02	-x-	xxxx.xxx	-xxx.xx	-( )	-x-	x	-xxxxxx.x	-x-	xxxxxx.x	-x-	-x-	x

Subcarrier Discriminator

a. Design sequence.
02 = Standard.

b. Power.
0 = 105V to 132V rms, 47 Hz to 65 Hz (Standard).
7 = 105V to 132V rms, 360 Hz to 440 Hz.
8 = 207V to 253 rms, 47 Hz to 65 Hz.

c. Center frequency in 7 digit kHz.

d. Deviation in 5 digit kHz for CBW or 5 digit % for PBW.

e. (k) for CBW
(%) for PBW

f. Bandpass input filter.
1 = 4-pole pair linear phase, deviation $\leq$ 30%.
2 = 2-pole pair linear phase.
3 = Not desired.

g. Low-pass output filter.
2 = 5-pole CA.
3 = 5-pole CD.
5 = 7-pole CA.
6 = 7-pole CD.
7 = 5-pole, either CA or CD for each of two switchable cutoff frequencies between 3 Hz and 20 kHz.

h. Low-pass output filter cutoff frequency in 7 digit Hz.
First cutoff frequency when -7 output filter is used.

i. Characteristic for first cutoff frequency when -7 output filter is used.
1 = CA.
2 = CD.

j. Second cutoff frequency when -7 output filter is used.

Table 2-2 (Cont'd), EMR 4150-02
Discriminator Part Number Identification

k. Characteristic for second cut-off frequency when 7 output filter is used.
1 = CA.
2 = CD.

l. Panel paint and lettering (W or B following color codes refer to white or black lettering).
4 = Gray (26492B) (Standard)
9 = Special (selected from FED-STD-595).

m. Zero signal circuit and indicator option.
0 = Not desired.
1 =Desired.

Table 2-3. Model 4151
Channel Selector Part Number Identification

	a b c d
Model 4151-xx-xxxx.xxx-xxx.xx-( ) Channel Selector	

a. Bandpass input filter
01 = 4-pole pair linear phase, deviation $\leq$ 30%
02 = 2-pole pair linear phase.
03 = Not desired.

b. Subcarrier center frequency in 7 digit kHz.

c. Deviation in 5 digit kHz for CBW or 5 digit % for PBW.

d. (k) for CBW
(%) for PBW

Table 2-4. Model 4157 LPOF and
Output Amplifier Part Number Identification

Model 4157-a-b-c-d-e Output Filter
a. Design sequence. 02 = 5-pole CA. 03 = 5-pole CD. 05 = 7-pole CA. 06 = 7-pole CD. 07 = 5-pole, either CA or CD for each of two switchable cutoff frequencies between 3 Hz and 20 kHz. b. Cutoff frequency in 7 digit Hz. First cutoff frequency when 07 output filter is used. c. Characteristic for first cutoff frequency when -07 output filter is used. 1 = CA. 2 = CD. d. Second cutoff frequency when -07 output filter is used. e. Characteristic for second cutoff frequency when -07 output filter is used. 1 =CA. 2 = CD.

Table 2-5. IRIG and EMR Constant-Bandwidth Telemetry Channels

±1-kHz Deviation		±2-kHz Deviation		±4-kHz Deviation		±8-kHz Deviation	
EMR Ch. No.	Center Freq. (kHz)	IRIG Ch. No.	Center Freq. (kHz)	IRIG Ch. No.	Center Freq. (kHz)	IRIG Ch. No.	Center Freq. (kHz)
1	8						
2	12						
3	16	1A	16				
4	20						
5	24	2A	24				
6	28						
7	32	3A	32	3B	32		
8	36						
9	40	4A	40				
10	44						
11	48	5A	48	5B	48		
12	52						
13	56	6A	56				
14	60						
15	64	7A	64	7B	64	7C	64
16	68						
17	72	8A	72				
18	76						
19	80	9A	80	9B	80		
20	84						
21	88	10A	88				
		11A	96	11B	96	11C	96
		12A	104				
		13A	112	13B	112		
Ref.	120	14A	120				
		15A	128	15B	128	15C	128
		16A	136				
		17A	144	17B	144		
		18A	152				

Table 2-5 (Cont'd) IRIG and EMR Constant-Bandwidth Telemetry Channels

±1-kHz Deviation		±2-kHz Deviation		±4-kHz Deviation		±8-kHz Deviation	
EMR Ch. No.	Center Freq. (kHz)	IRIG Ch. No.	Center Freq. (kHz)	IRIG Ch. No.	Center Freq. (kHz)	IRIG Ch. No.	Center Freq. (kHz)
		19A	160	19B	160	19C	160
		20A	168				
		21A	176	21B	176		
				23B*	192	23C*	192
		Ref.	240	Ref.	240	Ref.	240

*Not IRIG-standard

Table 2-6. IRIG Proportional-Bandwidth Telemetry Channels

IRIG Channel Number	Channel Center Freq. (Hz)	Deviation	Low Band Edge (Hz)	High Band Edge (Hz)	Date Cutoff Freq.(Hz)
1	400	±7.5%	370	430	6
2	560	±7.5%	518	602	8
3	730	±7.5%	675	785	11
4	960	±7.5%	888	1032	14
5	1300	±7.5%	1202	1398	20
6	1700	±7.5%	1572	1828	25
7	2300	±7.5%	2127	2473	35
8	3000	±7.5%	2775	3225	45
9	3900	±7.5%	3607	4193	59
10	5400	±7.5%	4995	5805	81
11	7350	±7.5%	6799	7901	110
12	10,500	±7.5%	9712	11,288	160
13	14,500	±7.5%	13,412	15,588	220
14	22,000	±7.5%	20,350	23,650	330
15	30,000	±7.5%	27,750	32,250	450
16	40,000	±7.5%	37,000	43,000	600
17	52,005	±7.5%	48,562	56,438	790
18	70,000	±7.5%	64,750	75,250	1050
19	93,000	±7.5%	86,025	99,975	1395
20	124,000	±7.5%	114,700	133,300	1860
21	165,000	±7.5%	152,625	177,375	2475
A	22,000	±15%	18,700	25,300	660
B	30,000	±15%	25,500	34,500	900
C	40,000	±15%	34,000	46,000	1200
D	52,500	±15%	44,625	60,375	1575
E	70,000	±15%	59,500	80,500	2100
F	93,000	±15%	79,050	106,950	2790
G	124,000	±15%	105,400	142,600	3720
H	165,000	±15%	140,250	189,750	4950

Table 2-7. EMR 12-Channel Constant-Bandwidth Instrumentation Systems

EMR Channel Number	Discriminator Frequency Same as Channel No.	Subcarrier Frequency Deviation (kHz)					
		±1	±2	±4	±8	±16	±32
		Subcarrier Center Frequency (kHz)					
1	1	8	16	32	64	128	256
2	2	12	24	48	96	192	384
3	3	16	32	64	128	256	512*
4	4	20	40	80	160	320	640
5	5	24	48	96	192	384	768*
6	6	28	56	112	224	448	896
7	6	32	64	128	256	512	1024*
8	5	36	72	144	288	576	1152
9	4	40	80	160	320	640	1280*
10	3	44	88	176	352	704	1408
11	2	48	96	192	384	768	1536*
12	1	52	104	208	416	832	1664
-·- Reference ———		60	120	240	480	960	1920

*These frequencies, plus a 1792 kHz reference signal, can be used in a five-channel, ±64 kHz-deviation system.

SECTION 3

INSTALLATION AND OPERATION

3.1 INSTALLATION

The EMR 4150-02 Subcarrier Discriminator is shipped completely assembled and ready for installation. The unit should be inspected immediately on its arrival and notice given to EMR-Telemetry of any claim that the product does not conform with the terms of the order.

The 4150 is a modular unit designed for installation in an EMR Model 4005 Rack Adapter. Up to fourteen units may be installed in a single rack adapter. The rack adapter is intended for installation in a standard 19-inch equipment rack or portable instrument case. (For information pertinent to the rack adapter, refer to the EMR Model 4005 Rack Adapter Instruction Manual.)

To install the 4150, align the unit on the T-rails on the bottom surface of the rack adapter interior and insert the unit. The connector on the rear of the 4150 mates with a connector in the rack adapter interior completing the electrical connection. A float-mounted connector is used on the rack adapter assuring proper electrical mating. After insertion into the rack adapter, the push-to-lock knob on the lower section of the 4150 front panel is depressed securing the unit in the rack adapter. The electrical connections terminated at the 4150 rear connector and the rear connector pin layout are shown in Figure 3-1.

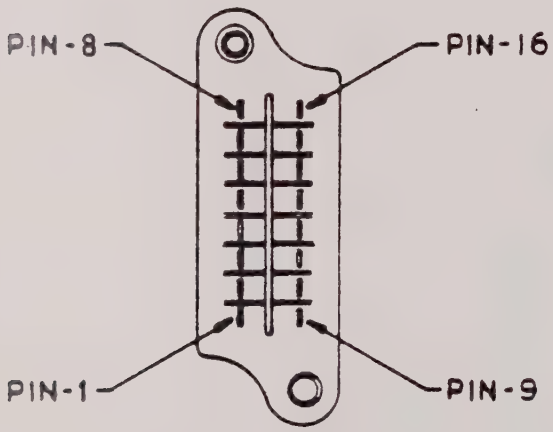
The 4150 is removed from the rack adapter by releasing the push-to-lock knob and pulling the unit straight out. Servicing of the 4150 is enabled by using the EMR Model 4601 Test Adapter. The test adapter is installed in the rack adapter in the location assigned to the 4150. A connector on the test adapter then plugs into the rear connector of the 4150. Test points on the test adapter provide access to each terminal of the 4150 rear connector.

3.2 OPERATION

3.2.1 Front Panel Controls, Indicators and Test Jacks

The front panel controls, indicators and test jacks used for operation of the 4150 are illustrated in Figure 3-2 and described in Table 3-1. Two marking strips are included on top of the unit front panel which identifies the unit operating parameters. The top strip identifies the center frequency and deviation while the second strip identifies the lowpass output filter (LPOF) characteristic and cutoff frequency. For the switchable LPOF (4157-07), both cutoff frequencies are identified on the strip. The characteristics of the filter (4157-07) are identified by referring to the model number of the unit.

Rear Connector J1 Pin Layout



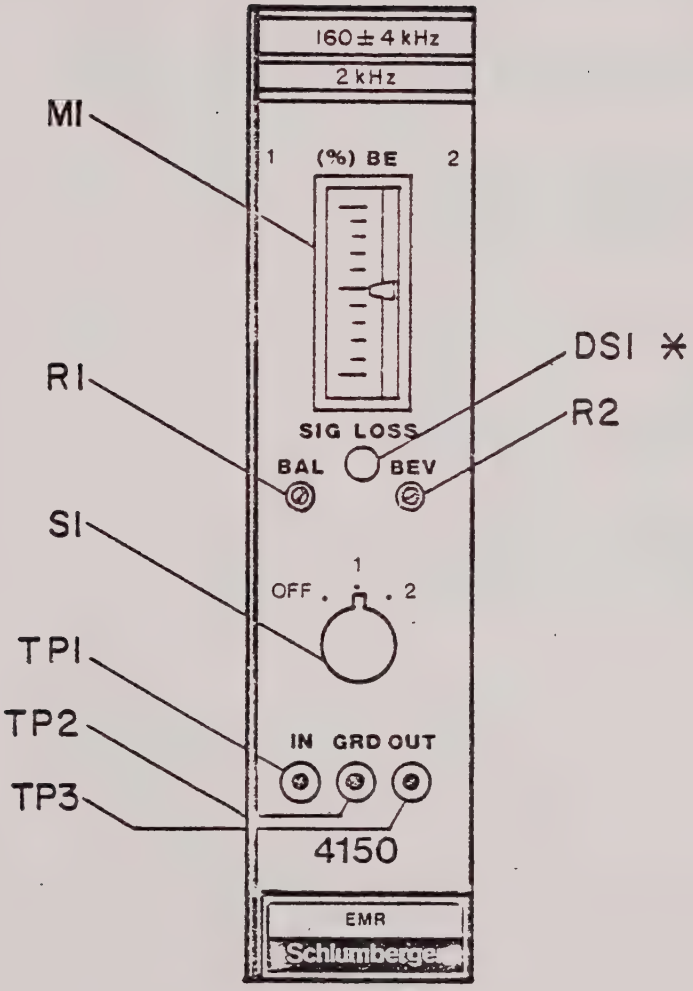
External Connections

J1 THRU J14	
PIN	FUNCTION
1	TAPE SPEED COMP INPUT
2	TAPE SPEED COMP RETURN
3	
4	
5	
6	DATA OUTPUT
7	115V (NEUTRAL)
8	115V (PHASE)
9	
10	
11	——— 1 ———
12	——— 1 ———
13	
14	SUBCARRIER INPUT
15	SIGNAL GROUND
16	CHASSIS GROUND

OTES:

> RESERVED FOR EXTERNAL DELAY LINE CONNECTIONS.

Figure 3-1. EMR 4150-02 External Electrical Connections



* THIS DISPLAY IS PROVIDED WHEN THE SIGNAL LOSS OPTION IS INCLUDED.

Figure 3-2. EMR 4150-02 Front Panel Controls, Indicators, and Test Jacks

Table 3-1. Function of Front Panel Controls, Indicators and Test Jacks (Ref. Figure 3-2)

DESIG.	NAME	FUNCTION
M1	% B. E. Meter	Provides indication of relative position of subcarrier input within bandedge-to-bandedge range.
R1	BAL Potentiometer	Balances the output voltage around zero for normal operation.
R2	BEV Potentiometer	Adjusts the data output voltage. This voltage is adjustable from ±0.1 volt to ±10.5 volts for full bandedge-to-bandedge deviation.
S1	OFF/1/2 Switch	Power ON/OFF and output filter select switch. When any output filter except the Model 4157-07 is included, the switch is only an ON/OFF switch. Position 1 or 2 may be used for the ON mode. When a 4157-07 is included, the switch selects the parameters identified on the marking strip.
TP1	IN Test jack	Subcarrier signal at the BPIF output.
TP2	GRD Test jack	Ground
TP3	OUT Test jack	Data Output

3.2.2 Operational Adjustments

The front panel operating controls, BEV potentiometer R2 and BAL potentiometer R1, should be checked and, if necessary, adjusted often to insure accurate calibration. The procedures for these adjustments are provided in the following paragraphs.

3.2.2.1 Balance Adjustment

The balance (BAL) potentiometer, R1, is adjusted to provide a 0-volt data signal output with a center frequency input. To perform this adjustment, proceed as follows:

a. Apply a center frequency input to the 4150 to be adjusted.

b. Connect a DC voltmeter to test jack TP3 (OUT) on the front panel.

c. Adjust BAL potentiometer R1 for an indication of 0 volt on the voltmeter.

d. If balance cannot be obtained, trouble may be caused by normal aging of components and can be compenstated for as follows --

1. Set BAL control to center of range.

2. Substitute a resistive decade box for resistor R20 connected between terminals E11 and E12 on 4151 Channel Selector (see Figures 5-6 and 5-7).

3. Adjust the resistive decade box to obtain a 0-volt indication at TP3 (OUT) on the front panel. Inability to obtain 0-volt indication indicates a defect elsewhere in the unit. Refer to Section 5 for maintenance.

4. Install the nearest standard resistive value to the value indicated on the decade box.

NOTE

If value indicated on decade box exceeds 1K, change value of R21 so unit will balance with R20 < 1K.

3.2.2.2 Bandedge Output Voltage Adjustment

The data output voltage of a 4150 is adjustable from ±0.1 volt to ±10.5 volts for full bandedge-to-bandedge deviations. To adjust the bandedge output voltage, proceed as follows:

a. Using a test oscillator, apply a frequency input to the 4150 to be adjusted, equivalent to the upper bandedge frequency for that unit.

b. Connect a DC voltmeter to test jack TP3 (OUT) on the front panel.

c. Adjust BEV potentiometer R2 for the required peak output voltage.

SECTION 4

THEORY OF OPERATION

4.1 GENERAL

This section provides theory of operation for the circuits of the EMR 4150-02 Subcarrier Discriminator. Circuit descriptions are arranged in signal flow sequence through the two major functional areas of the 4150 (Model 4151 Channel Selector and Model 4157 LPOF and Output Amplifier) and are referenced to the detailed block diagram, Figure 4-1. The optional signal loss circuit is discussed in paragraph 4.4. Operation of the power supply regulator circuits is provided in paragraph 4.5. Complete schematic diagrams for the 4150 are provided in Section 5 for reference and maintenance purposes.

4.2 MODEL 4151 CHANNEL SELECTOR (REF. FIGURE 4-1)

4.2.1 General

The Model 4151 Channel Selector contains an input amplifier, a bandpass input filter (Models 4151-01 and 4151-02 only), a differential amplifier, a limiter, a Schmitt trigger, a tape speed compensation and temperature compensation network, an FM detector and driver, and a voltage switch with deviation sensitivity components. Functional descriptions of these circuits are provided in the following paragraphs.

4.2.2 Input Amplifier

The subcarrier multiplex or single channel input to the 4150 is coupled from pin 14 of rear panel connector J1 through pin 14 on the channel selector card to input amplifier circuit Z1. The input amplifier provides a high input impedance for the input signal and a low output impedance for driving the bandpass input filter (BPIF). In Model 4151-01 and Model 4151-02 Channel Selectors, the output of amplifier Z1 is applied to bandpass input filter FL1. The Model 4151-03 Channel Selector is used with single channel subcarrier inputs only and therefore does not require an input filter. Thus, in the Model 4151-03 Channel Selector the output of amplifier Z1 is coupled to the input of the differential amplifier circuit through the RC network consisting of resistor R73 and capacitor C44.

4.2.3 Bandpass Input Filter (BPIF)

The BPIF is tuned to extract a single subcarrier channel from an FM multiplex of subcarrier channels. The BPIF is the particular circuit area in which the Model 4151-01 and Model 4151-02 Channel Selectors differ. A brief description of the type BPIF in each model is provided below:

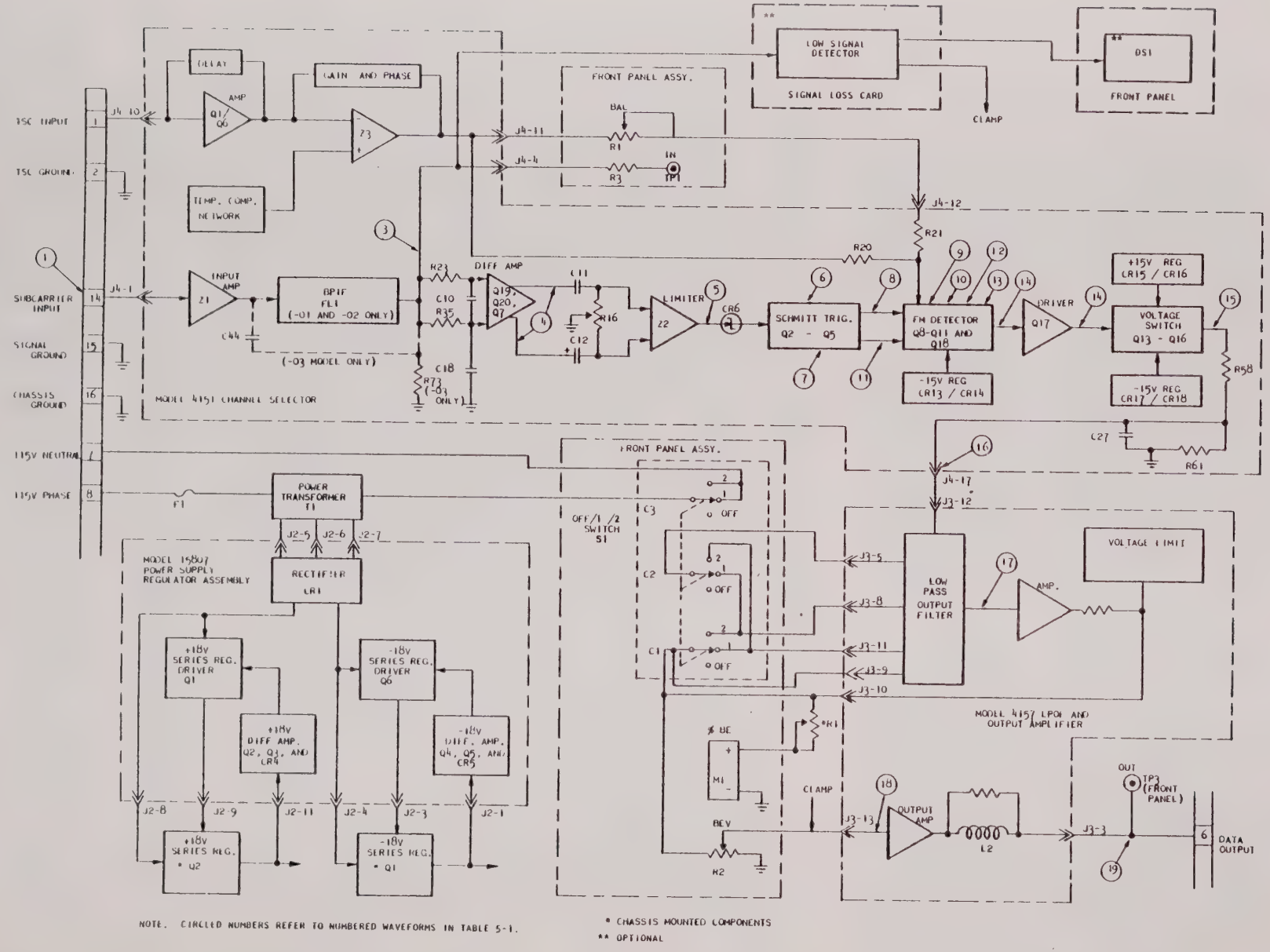


Figure 4-1. EMR 4150-02 Subcarrier Discriminator Detailed Block Diagram

a. Model 4151-01 BPIF -- Contains a four-pole Linear-phase band-pass filter. The filter may have any of 3 separate types of synthesis which are: (1) active RC filter, (2) stagger-tuned passive filter, or (3) passive ladder type. The type of filter used is dependent upon center frequency and deviation parameters. Deviation limitations are ±2.5% through ±30%. The filters are individual assemblies mounted on the channel selector printed-circuit card.

b. Model 4151-02 BPIF -- Contains a two-pole linear-phase active RC filter or passive ladder filter. The type of filter used is dependent upon the center frequency and deviation parameters. Deviations from ±2.5% through ±45% are available. The filters are individual assemblies mounted on the channel selector printed-circuit card.

4.2.4 Differential Amplifier, Limiter, and Schmitt Trigger

The differential amplifier, limiter, and Schmitt trigger circuits operate in conjunction as a squaring circuit/level shifter network to provide complementary, constant-amplitude, square wave inputs to the FM detector, representative of the selected subcarrier input signal. The zero crossings of the signal input are maintained thus maintaining the modulation component of the subcarrier signal. The BPIF output (waveform 3 of Table 5-1) is routed to the differential amplifier stage composed of transistors Q19 and Q20. Transistor Q7 functions as a constant current source for transistors Q19 and Q20. The differential outputs of amplifier Q19/Q20 (waveform 4 of Table 5-11) are applied to integrated circuit Z2, a high gain limiter/comparator circuit. Potentiometer R16 across the inputs to Z2 controls the symmetry of the limiter/comparator output signal. (See waveform 5 of Table 5-1.) The output of limiter/comparator Z2 is coupled through zener diode CR6 which shifts the level of the drive signal input to the Schmitt trigger circuit. The Schmitt trigger, composed of transistors Q2 and Q3, shapes the subcarrier signal and provides complementary square-wave outputs. (See waveforms 6 and 7 of Table 5-1.) The square-wave outputs of the Q2 and Q3 are coupled through transistor stages Q4 and Q5 to the FM detector circuit. Transistors Q4 and Q5 are connected in a differential amplifier configuration which shifts the level of the Schmitt trigger outputs and provides the drive required for operation of the FM detector. (See waveforms 8 and 11 of Table 5-1.)

4.2.5 Tape-Speed Compensation (TSC) and Temperature Compensation (TC) Circuit

The TSC and TC circuits actually differ in function but are combined in the same network because both circuits ultimately compensates the FM detector. Temperature variations and tape-speed errors produce similar effects on operation of the discriminator.

The TSC and TC circuits in conjunction with the front panel BAL control, R1 provide a source voltage for frequency determining components in the FM detector. Initially, the BAL control is adjusted such that the FM detector provides an output equivalent to a 0-volt data signal with a subcarrier center frequency input. When tape-speed variations and/or temperature variations occur, the source voltage from the TSC and TC circuits changes an amount necessary to compensate for the variations.

Since the TSC error input to the TSC circuit is used to compensate the FM detector, the TSC signal must occur simultaneously with the subcarrier signal input to the FM detector. When the subcarrier signal is extracted from the subcarrier multiplex, a certain amount of delay is incurred in the BPIF. This delay is dependent upon the subcarrier channel center frequency and deviation. A built-in delay network in the TSC circuit is designed to match the delay in the BPIF thereby assuring cancellation of any erroneous variations in the input signal.

4.2.6 FM Detector and Driver

The FM detector consists of two-quarter-cycle timing circuits which operate from complementary signals from the limiter circuit in the Model 4151 Channel Selector. The complementary input signals are square wave signals representative of the subcarrier signal input to the unit with the zero crossings maintained. With a center frequency input, the zero crossings are equally spaced and correspond to the center frequency zero crossings established in the unit. When a modulation component is introduced, the time between zero crossings changes proportionally from the center frequency zero crossings standard established in the unit. The FM detector thus detects the time between zero crossings and provides an output representing the frequency input.

Each quarter-cycle detector operates on alternate half cycles of the square wave inputs. A negative-going level at either input turns-off input transistors Q12 or Q18. In this condition, the appropriate timing capacitor, C22 or C23, charges toward the source voltage through R38 or R41. One quarter-cycle later, the voltage increases to a level necessary to trigger the comparator Q8 or Q11. The quarter-cycle periods differ depending upon the subcarrier channel center frequency; therefore, timing capacitors C22 and C23 are sized accordingly.

When either input changes to a positive level, the appropriate input transistor is turned on and the timing capacitor discharges. This action repeats each half cycle thus providing a time measurement between zero crossings in the subcarrier signal.

The comparator outputs, Q8 and Q11, are summed by transistor Q9 and coupled through an emitter-follower driver stage Q17 to the voltage switch. Typical waveforms for the FM detector are shown in Table 5-1, waveforms 8 through 14. By inspecting these waveforms, it is seen that, if the subcarrier frequency

increases, the positive portions of the summed output become shorter in duration than the negative portion since the negative portions are set to the fixed one-quarter cycle interval by the timing capacitors.

Transistor Q10 functions as a voltage clamp for the FM detector and zener diodes CR13 and CR14 establish a -15 volt reference level.

4.2.7 Voltage Switch and Deviation Sensitivity Components

The voltage switch operates from the FM detector output to establish precise amplitude levels for the detected subcarrier signal. This is a cross coupled network which is triggered on every edge of the FM detector output. Zener diodes, connected to the ±18 volts regulated DC supplies, establish reference voltages of +15 volts and -15 volts. The square wave input to the voltage switch is then converted to an output signal with a ±15 volts magnitude (see waveform 15 of Table 5-1).

The deviation sensitivity components are connected as a resistive voltage divider and RC integrator.

The output of the RC integrator (waveform 16 of Table 5-1) is routed from pin 17 of connector J4 on the Model 4151 Channel Selector card to pin 12 of connector J3 on the Model 4157 LPOF and Output Amplifier card.

4.3 MODEL 4157 LPOF AND OUTPUT AMPLIFIER (REF. FIGURE 4-1)

4.3.1 General

The Model 4157 LPOF and Output Amplifier card is composed of a low-pass output filter and amplifier with an output voltage limiter, and an output amplifier circuit. The various configurations of the Model 4157 available are identified by the type of low-pass output filter provided on each card. The output filter types are described as follows:

a. Model 4157-02 LPOF -- The Model 4157-02 output filter is a 5-pole unit having fixed constant amplitude (CA) response characteristic with asymptotic rolloff of 30 db per octave. Cutoff frequencies for the Model 4157-02 are available between 3 Hz and 450 KHz.

b. Model 4157-03 LPOF -- The Model 4157-03 output filter is the same as the Model 4157-02 except the response characteristic is constant delay (CD) only.

c. Model 4157-05: Same as the 4157-02 except that this is a 7-pole filter with an asymptotic rolloff of 42 db/octave.

d. Model 4157-06: Same as the 4157-05 except has a constant delay characteristic.

e. Model 4157-07: This filter is a 5-pole dual switchable network. Two different cutoff frequencies may be included with a CA or CD response characteristic. The asymptotic rolloff is 30 db/octave and the operating frequencies available are 3Hz through 20KHz.

The constant amplitude response characteristic is used to provide a relatively constant amplitude in the passband. The constant delay characteristic filters are used where pulse response is important or in time correlated systems where phase linearity is desirable. The following paragraphs describe the operation of the Model 4157 circuits on the basis of signal flow. (See Figure 4-1.)

4.3.2 Low-Pass Output Filter, Filter Amplifier, and Voltage Limiter

The output of the deviation sensitivity network on the channel selector card is applied to the Model 4157 card at pin 12 of connector J3 and routed to the low-pass output filter. The output filter is an active network that removes the subcarrier frequency components of the input signal while passing the modulation components of the signal. Each filter is made up primarily of R-C combinations connected in a basic low-pass configuration. The filter output is applied to an amplifier which controls the gain of the filter network and isolates the filter from external circuits. The voltage limiter circuit limits the output voltage to 125% of the normal bandedge voltage. The Model 4157-07 is a switchable LPOF as controlled by the front panel OFF/1/2 switch. There are two outputs (+18V and -18V) from the switch to the LPOF card at pins 9 and 5. These pins are jumpered to terminals on the card and provide switching levels for FET's and switching transistors. The jumper wiring is variable depending on the parameters of the two filters. A +18V level at an FET or switching transistor saturates the component connecting certain passive components into the filter. To establish the jumper wiring; refer to the card, the card assembly diagram (Figure 5-12), and the card schematic diagram (Figure 5-13).

The output of the amplifier stage is applied to bandedge deviation (% B.E.) meter M1 and bandedge voltage (BEV) potentiometer R2, all of which are located on the front panel. Interconnect card mounted potentiometer R1 controls the sensitivity of meter M1 for bandedge-to-bandedge deviations. By controlling amplitude of the input signal applied to the output amplifier, the bandedge volts (BEV) potentiometer, R2, controls the resultant output amplitude.

4.3.3 Output Amplifier And Current Limiters

The output amplifier circuit is a wideband, medium power operational amplifier that provides an output of up to ±10.5 volts at 100 milliamperes over the bandwidth of DC to 450 KHz. The operational amplifier has a fixed gain of approximately 6.2. The output voltage is determined by the magnitude of the voltage selected at the front panel bandedge volts (BEV) control; however, the maximum output voltage is approximately 21 volts peak-to-peak (±10.5 volts for bandedge-to-bandedge deviation).

Current for operation of the amplifier power output stage is supplied by plus and minus current limiters. Normal current available is ±100 milliamperes for data frequencies up to 450 KHz with maximum allowable current limited to ±130 milliamperes. A short circuit output will not damage any components of the output amplifier. Maximum current supplied for a short-circuit condition is not greater than 130 milliamperes.

4.4 SIGNAL LOSS CIRCUITS (REF. FIGURES 4-1 and 5-18)

The signal loss circuits operate from a level obtained at the BPIF output to determine a low signal condition. Two functions are performed by the signal loss circuits, the first is to illuminate a front panel LED indicator and the second is to clamp the unit data output. The signal level obtained from the BPIF is routed to the signal loss card circuits via card terminal E2. Transistors Q1 and Q2 form a differential amplifier which supplies an amplified signal across potentiometer R16. This potentiometer is used to set the signal loss threshold level. Amplifier stage U1 in conjunction with diode CR4 forms a peak detector and rectifier network which supplies a positive level to comparator U2. As long as this positive level is higher than a reference level at the U2 plus (+) input, U2 supplies a negative output to transistors Q3 and Q4 which keeps Q3 and Q4 in an off condition. However, should the level at the U2 minus (-) input drop below the reference level, the U2 output increases to a positive level turning Q3 and Q4 on. With these transistors on, the lamp is illuminated and the output is clamped.

4.5 POWER SUPPLY REGULATOR (REF. FIGURES 4-1 AND 5-15)

The power supply regulator card circuits, together with chassis-mounted transformer T1 and series regulator transistors Q1 and Q2, operates from the primary AC power input and generates the primary DC operating voltages for the Model 4150. The AC power input at pin 8 of rear connector J1 is routed to transformer T1 through fuse F1 which provide overload protection for the power supply circuits. On/off control for the power supply is accomplished by routing the AC neutral input at pin 7 of connector J1 through front panel OFF/1/2 switch S1 to transformer T1. The secondary winding of T1 is connected across a dual full-wave diode rectifier assembly, CR1, which provide unregulated DC voltages to the positive and negative voltages regulator circuits.

Regulation in the plus regulator, consisting of card transistors Q1 through Q3 and chassis-mounted transistor Q2, is accomplished by comparing a sample of the output voltage with a voltage reference established by zener diode CR4. A differential amplifier consisting of transistors Q2 and Q3 senses the magnitude and polarity of any output voltage change and produces an output that is proportionally equal and opposite to the error detected. The error controls the biasing of series regulator driver stage Q1 which in turn controls the biasing of chassis-mounted series regulator transistor, Q2.

Regulation in the minus regulator consisting of card transistors Q4 through Q6 and chassis-mounted transistor Q1 is accomplished in an identical manner as that described for the plus regulator.

SECTION 5

MAINTENANCE

5.1 GENERAL

This section contains information to aid in troubleshooting and maintaining the EMR 4150-02 Subcarrier Discriminator. This information is intended for use in conjunction with the theory of operation contained in Section 4 so that maintenance may be performed with maximum efficiency. Included in the maintenance information is a troubleshooting guide and assembly and schematic diagrams for major assemblies of the 4150.

5.2 TROUBLESHOOTING

The general method for troubleshooting the 4150 is as follows:

a. Perform an inspection (paragraph 5.2.1)

b. Check power supply card for proper operation (paragraph 5.2.2).

c. Check discriminator waveforms to isolate the malfunction to a functional circuit (paragraph 5.2.3).

d. Check transistor voltage measurements in malfunctioning circuit (paragraph 5.2.4).

e. When defective component is isolated, refer to Section 6 for replacement component information.

5.2.1 Inspection

The 4150 should be subjected to a regular inspection program. The inspection should be performed periodically as a means of preventive maintenance or, if a malfunction occurs, to aid in isolating the trouble. An inspection should include the following:

a. Inspect front and rear panel components for signs of damage or looseness.

b. Remove the cover and inspect the internal wiring of the chassis and plug-in assemblies for loose or broken connections.

c. Inspect plug-in assemblies for mechanical damage or component discoloration.

5.2.2 Power Supply Check (Ref. Figures 5-14 and 5-15)

Before troubleshooting any 4150 circuits, check the power supply/regulator for proper outputs. The following guide should be used to check the power supply.

a. Remove the cover from the chassis assembly and extend the unit from the rack adapter using a test adapter.

b. Position front panel OFF/1/2 switch to 1 or 2 and, using a DC voltmeter, monitor power supply card pins J2-11 and J2-1 for +18 and -18 volts ±100 millivolts, respectively. Ripple shall be less than 10 millivolts peak-to-peak.

c. If voltages are in error, troubleshoot power supply regulator circuits using the schematic diagram and transistor voltage measurements contained in Table 5-5.

5.2.3 Circuit Waveforms

The circuit waveforms are designed to isolate a malfunction to a functional circuit in the discriminator. These waveforms are shown in Table 5-1. Figure 4-1, detailed block diagram, should be used in conjunction with the discriminator waveform table since this diagram illustrates all functional circuits and prime signal flow in the unit.

The waveforms shown in Table 5-1 are typical for any discriminator configuration, however, when applying an input signal, the signal parameters must correspond to the parameters established by the plug-in units.

To check the waveforms, the following preliminary steps shall be taken:

a. Remove the cover from the 4150 and extend the unit from the rack adapter using a test adapter (EMR Model 4601).

b. Obtain a subcarrier oscillator with operating parameters of the channel selector installed in the unit.

c. Supply a ground level potential to the tape-speed compensation (TSC) input of the discriminator.

d. Apply a subcarrier signal of 2 volts peak-to-peak at the center frequency of the subcarrier channel.

5.2.4 Transistor Voltage Measurements

Transistor voltage measurements for the plug-in assemblies of the 4150 are contained in Tables 5-2 through 5-5. It should be noted that the voltage in Tables 5-2 through 5-5 are typical for circuits during normal operation and that the actual voltages may differ slightly from those provided. However, in a malfunctioning circuit, the readings will differ significantly from the typical voltages. Access to the transistors on the plug-in cards is obtained by removing the cover from the unit and extending the unit from the rack adapter using a test adapter.

5.3 ADJUSTMENTS

Adjustments to variable components in the 4150 may be necessary following replacement of a defective component or after long periods of operation. Adjustments which can be made to the 4150 are identified as follows:

a. Balance Adjustment.

b. Bandedge Output Voltage Adjustment.

c. Symmetry Adjustment.

d. L.P.O.F. Offset Adjustment.

e. Bandedge Meter Zero Adjustment.

f. Bandedge Meter Sensitivity Adjustment.

Adjustments a and b are operational adjustments and are outlined in Section 3, paragraph 3.2. The procedures for maintenance adjustments c through f are provided in the following paragraphs.

5.3.1 Symmetry Adjustment

To adjust the output symmetry of limiter stage Z2 on the Model 4151 Channel Selector proceed as follows:

a. Remove the 4150 from the rack adapter, remove the cover, and extend the unit from the rack adapter using a test adapter.

b. Remove subcarrier input to the 4150 and connect a shorting lead between pins 1 and 2 of connector J4 on the channel selector card.

c. Connect an oscilloscope to the junction of diode CR6 and resistor R17 on the channel selector card.

d. Adjust potentiometer R16 on the channel selector card to the point at which the noise signal displayed on the oscilloscope is centered in the dynamic operating range of limiter Z2. (Nominally +1.15V DC).

e. Remove the test adapter, replace the cover, and reinstall the unit in the rack adapter.

5.3.2 Low-Pass Output Filter Offset Adjustment

To adjust for the offset of the low-pass output filter proceed as follows:

a. Remove the 4150 from the rack adapter, remove the cover, and extend the unit from the rack adapter using a test adapter.

b. Remove the Model 4151 Channel Selector card and connect pin J4-17 on the Interconnection Assembly to pin J4-16 through a 1K resistor.

c. Connect an oscilloscope to pin 10 on the Model 4157 card.

d. Adjust the offset compensation potentiometer (R39 on Models 4157-02/-03/-05/-06 LPOF and Output Amplifier card, or R20 on Model 4157-07 LPOF and Output Amplifier card) for a 0 volt ±20 millivolts output as indicated on the oscilloscope. Check both cutoff frequencies in the Model 4157-07.

e. Remove the test adapter, replace the cover, and reinstall the unit in the rack adapter.

5.3.3 Bandedge Meter Zero Adjustment

To zero the bandedge meter (M1) proceed as follows:

a. Remove the 4150 from the rack adapter and remove the cover.

b. Reinstall the 4150 on the rack adapter T-rails and insert the unit just far enough to hold it in the normal operating plane.

c. Using a non-metalic tool adjust the meter zero adjust control (behind the meter) to center the meter needle on the 0 position of the dial.

d. Remove the 4150, replace the cover, and reinstall the unit in the rack adapter.

5.3.4 Bandedge Meter Sensitivity Adjustment

To adjust the sensitivity of bandedge meter M1, proceed as follows:

a. Remove the 4150 from the rack adapter, remove the cover, and extend the unit from the rack adapter using a test adapter.

b. Supply an upper bandedge signal of 2 volts peak-to-peak to the 4150 under test.

NOTE

Refer to the front panel of the unit under test for designed center frequency and peak deviations.

c. Adjust potentiometer R1 on the interconnection board (see Figure 5-4) to the point at which the meter needle indicates full scale (upper bandedge) on the meter dial.

d. Remove the test adapter, replace the cover, and reinstall the 4150 in the rack adapter.

Table 5-1, EMR 4150-02 Subcarrier Discriminator, Circuit Waveforms (Ref. Fig. 4-1)

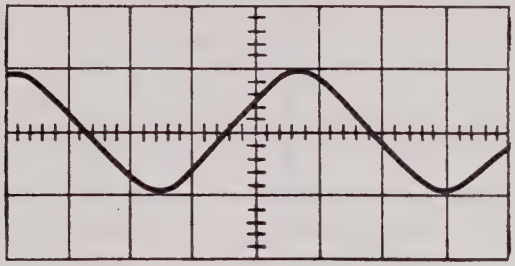
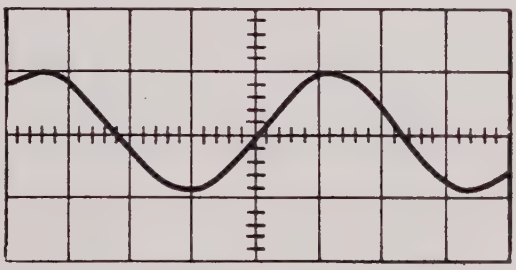
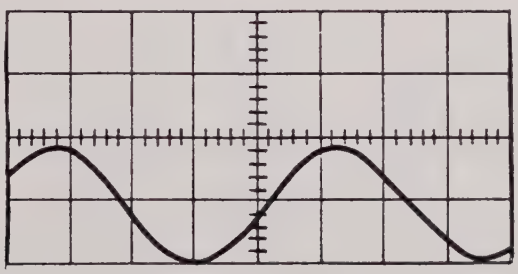
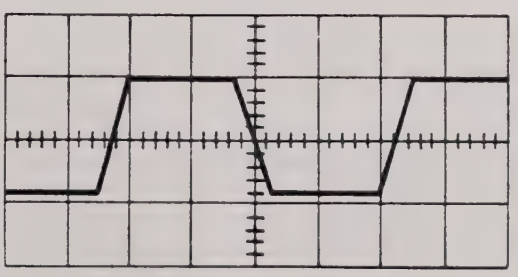
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Center frequency subcarrier input at rear connector J1 pin 14.	2-volts peak-to-peak	(1) 	1V/Cm	---
Input amp output at terminal E2 of channel selector card.	2-volts peak-to-peak	(2) 	1V/Cm	---
Bandpass input filter(BPIF) output at terminal E5 on channel selector card.	2-volts peak-to-peak	(3) 	1V/Cm	---
Differential amplifier output at collector of Q19 and Q20 on channel selector card.	2-volts peak-to-peak	(4) 	1V/Cm	

Table 5-1 (Cont'd). EMR 4150-02 Subcarrier Discriminator,
Circuit Waveforms (Ref. Figure 4-1)

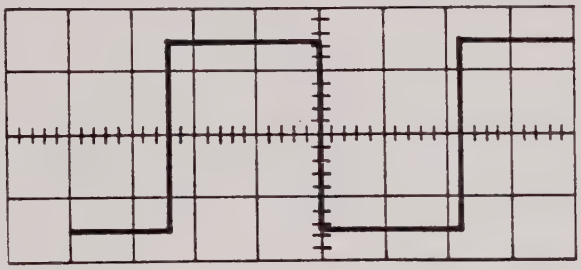
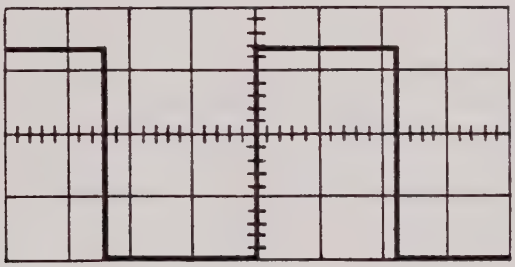
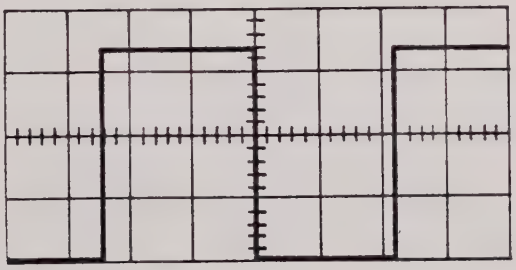
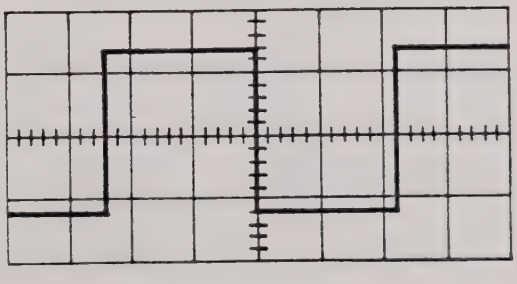
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Limiter output at junction of R17 and CR6 on channel selector card.	2-volts peak-to-peak	(5) 	1V/Cm	---
Schmitt trigger output at collector of Q2 on channel selector card.	2-volts peak-to-peak	(6) 	1V/Cm	---
Schmitt trigger output at collector of Q3 on channel selector card.	2-volts peak-to-peak	(7) 	1V/Cm	---
FM detector input at base of Q12 on channel selector card.	2-volts peak-to-peak	(8) 	0.5 V/Cm centered around -15V	---

Table 5-1 (Cont'd). **EMR 4150-02** Subcarrier Discriminator,

Circuit Waveforms (Ref. Figure 4-1)

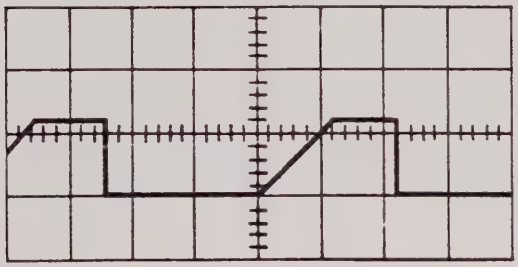
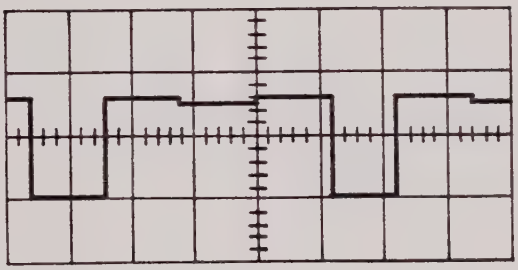
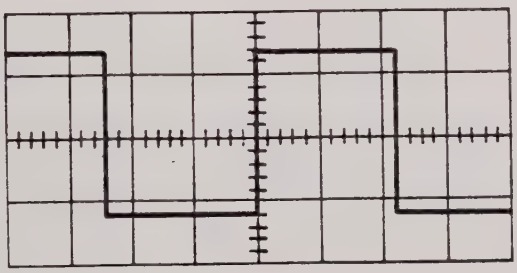
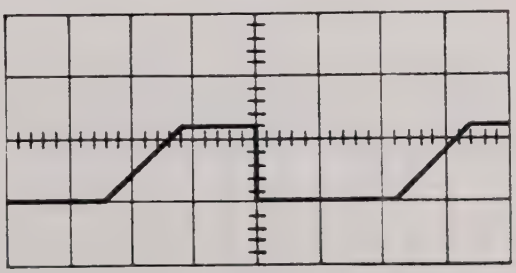
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Resultant 1/4-wave output at collector of Q12 on channel selector card.		(9) 	5V/Cm	---
Comparator output at collector of Q11 on channel selector card.		(10) 	5V/Cm	---
FM detector input at base of Q18 on channel selector card.	2-volts peak-to-peak	(11) 	0.5V/Cm centered around -15V	---
Resultant 1/4-wave output at collector of Q18 on channel selector card.	2-volts peak-to-peak	(12) 	5V/Cm	---

Table 5-1 (Cont'd). EMR 4150-02 Subcarrier Discriminator, Circuit Waveforms (Ref. Figure 4-1)

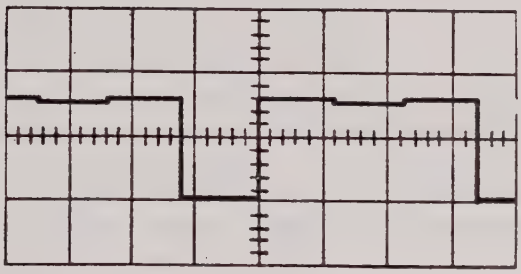
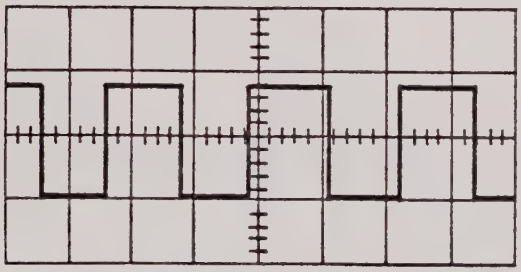
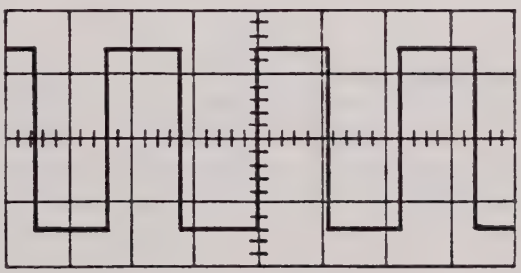
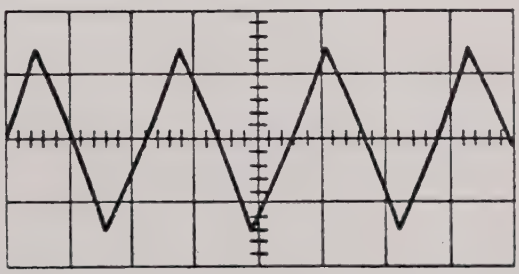
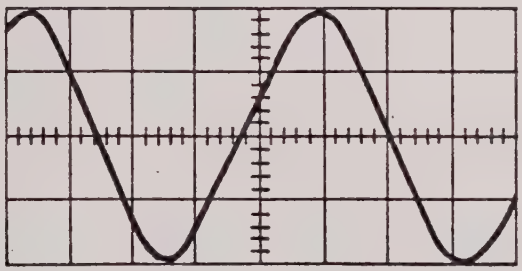
CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
Comparator output at collector of Q8 on channel selector card.	2-volts peak-to-peak	(13) 	5V/Cm	---
Summed output at collector of Q9 on emitter of Q17 on channel selector card.	2-volts peak-to-peak	(14) 	5V/Cm	---
Voltage switch output at terminal E27 of channel selector card.	2-volts peak-to-peak	(15) 	10V/Cm	---
Integrated waveform at pin J4-17 of channel selector card.	2-volts peak-to-peak	(16) 	Amplitude dependent upon deviation of unit being tested.	---

Table 5-1 (Cont'd). EMR 4150-02 Subcarrier Discriminator, Circuit Waveforms (Ref. Figure 4-1)

CIRCUIT LOCATION	INPUT	WAVEFORM	OSCILLOSCOPE	
			VERT.	HORIZ.
		NOTE For the remaining waveform, modulate the subcarrier signal input to the unit using a data signal of approximately 1/10 the cutoff frequency of the lowpass filter installed in the unit. The modulating data signal should deviate the subcarrier signal input from bandedge-to-bandedge.		
Lowpass output filter (LPOF) output at pin J3-10 of output amplifier card.	2-volts peak-to-peak with full scale data modulation.	(17) 	1V/Cm	---

NOTE

Check the unit output at front panel OUT test jack for the same signal as wave form 17 above except that the signal level is dependent on the setting of the BEV control. Ascertain that at least 21 volts peak-to-peak can be obtained.

Table 5-2. Model 4151 Channel Selector Transistor Voltages

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+9.8	+10.5	+18
Q2	*	*	*
Q3	*	*	*
Q4	*	*	*
Q5	*	*	*
Q6	GRD	+0.7	+10.5
Q7	-12.2	-11.5	*
Q8	-9.7	*	*
Q9	-9.7	*	*
Q10	-9.7	-9	GRD
Q11	-9.7	*	*
Q12	-15	*	*
Q13	+15	*	*
Q14	+15	*	*
Q15	-15	*	*
Q16	-15	*	*
Q17	*	*	GRD
Q18	-15	*	*
Q19	*	*	*
Q20	*	*	*

* Voltage level dependent upon input waveform, refer to Table 5-1, 4150 Circuit Waveforms.

Table 5-3. Model 4157-02/-03/-05/-06 LPOF and Output Amplifier Card Transistor Voltages

TRANSISTOR -02/-03/-05/-06	EMITTER	BASE	COLLECTOR
Q6-A	- 0.6	0.0	+18
Q6-B	- 0.6	0.0	+15.2
Q1	+14.5	+15.2	+18
Q3	+15.2	+14.5	+ 1.5
Q4	+ 0.8	+ 1.5	+17.4
Q2	+17.7	+17.0	+17.4
Q5	+ 0.1	+ 0.8	+17.4
Q9	-14.8	-14.1	- 1.5
Q10	- 0.8	- 1.5	-17.4
Q11	- 0.1	- 0.8	-17.4
Q12	-17.7	-17.0	-17.4
Q7	0.0	+ 1.85	0.0
Q8	0.0	+ 1.85	0.0

NOTES:

1. Use an oscilloscope for voltage measurements.
2. LPOF input terminated into 1K ohms (from card pin 13 to ground via 1K ohm resistor).

Table 5-4. Model 4157-07 LPOF and
Output Amplifier Card Component Voltages

COMPONENT	EMITTER	BASE	COLLECTOR
Q1	0.0	+1.85	0.0
Q2	0.0	+1.85	0.0
Q3	-0.8	-1.5	-17.4
Q4	+0.8	+1.5	+17.4
Q5	+0.1	+0.8	+17.4
Q6	-17.7	-17.0	-17.4
Q7	+17.7	+17.0	+17.4
Q8	-0.1	-0.8	-17.4
U3 pin 2	OV		
U3 pin 3	OV		
U3 pin 4	-18V		
U3 pin 6	OV		
U3 pin 7	+18V		

NOTES:

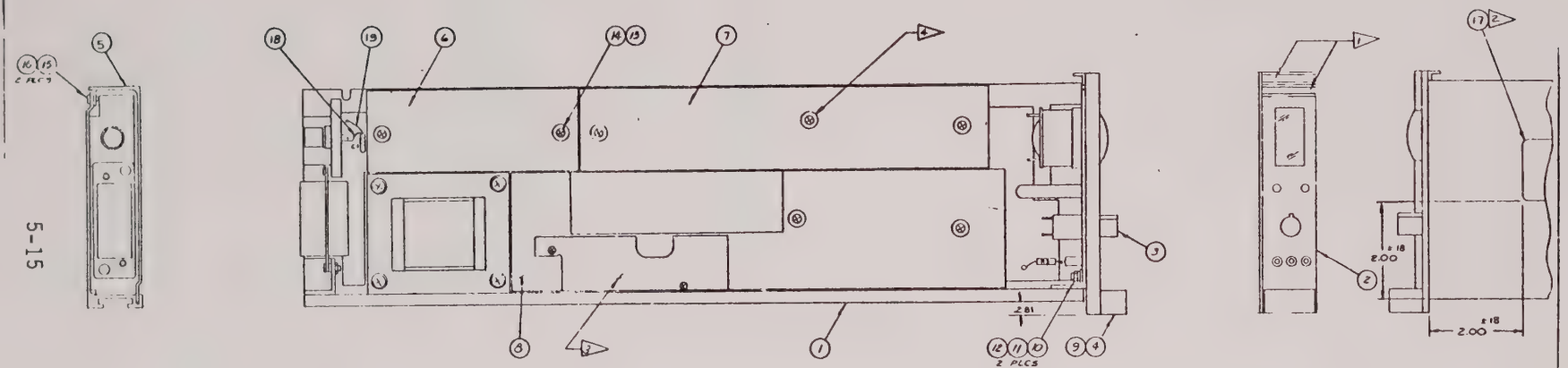
1. Use an oscilloscope for voltage measurements.
2. LPOF input terminated into 1K ohms (from card pin 13 to ground via 1K ohm resistor).

Table 5-5. Assembly No. 15807 Power Supply Regulator Assembly Transistor Voltages

TRANSITOR	EMITTER	BASE	COLLECTOR
Q1	+24 to +33	+23.4 to +32.4	+18.6
Q2	+8.4V	+9.0	+23.4 to +32.4
Q3	+8.4V	+9.0	+18.0
Q4	−8.4V	−9.0	−23.4 to −32.4
Q5	−8.4	−9.0	−18.0
Q6	−24 to −33	−23.4 to −32.4	−18.6
CHASSIS MOUNTED REGULATOR COMPONENTS			
Q1	−18	−18.6	−24 to −33
Q2	+18	+18.6	+24 to +33

NOTE:

1. Voltages taken during normal operation.
2. Use oscilloscope for voltage measurements.



NOTES:

1. REF. IDENTIFIER, EMR DWG NO. 15719 A SUPPLIED WITH ITEMS 7 & 8
2. APPLY APPLICABLE INFORMATION TO NAMEPLATE USING TYPEWRITER OR OTHER DEVICE WHICH PRODUCES AN EQUIVALENT TYPE FACE. CAPITAL LETTERS SHALL BE USED. COLOR OF MARKING SHALL BE BLACK. PROTECT MARKING WITH KRYLON NO. 1301 CLEAR SPRAY COATING OR EQUIVALENT.
3. WHEN LOSS OF SIGNAL CIRCUIT IS USED INSULATE THE COVER (ITEM 3) FROM PWA USING INSULATOR P/N 3241-2 (140-99-00028)(ITEM 20) INSTALLED 9.5 IN. FROM REAR OF UNIT.
4. THIS MTG POSITION NEED NOT BE USED IF NOT EASILY ACCESSIBLE.

ASSEMBLY
SUBCARRIER DISCRIMINATOR
MODEL 4150

06141 D 15710 M

Figure 5-1. Top Assembly Diagram, EMR 4150-02

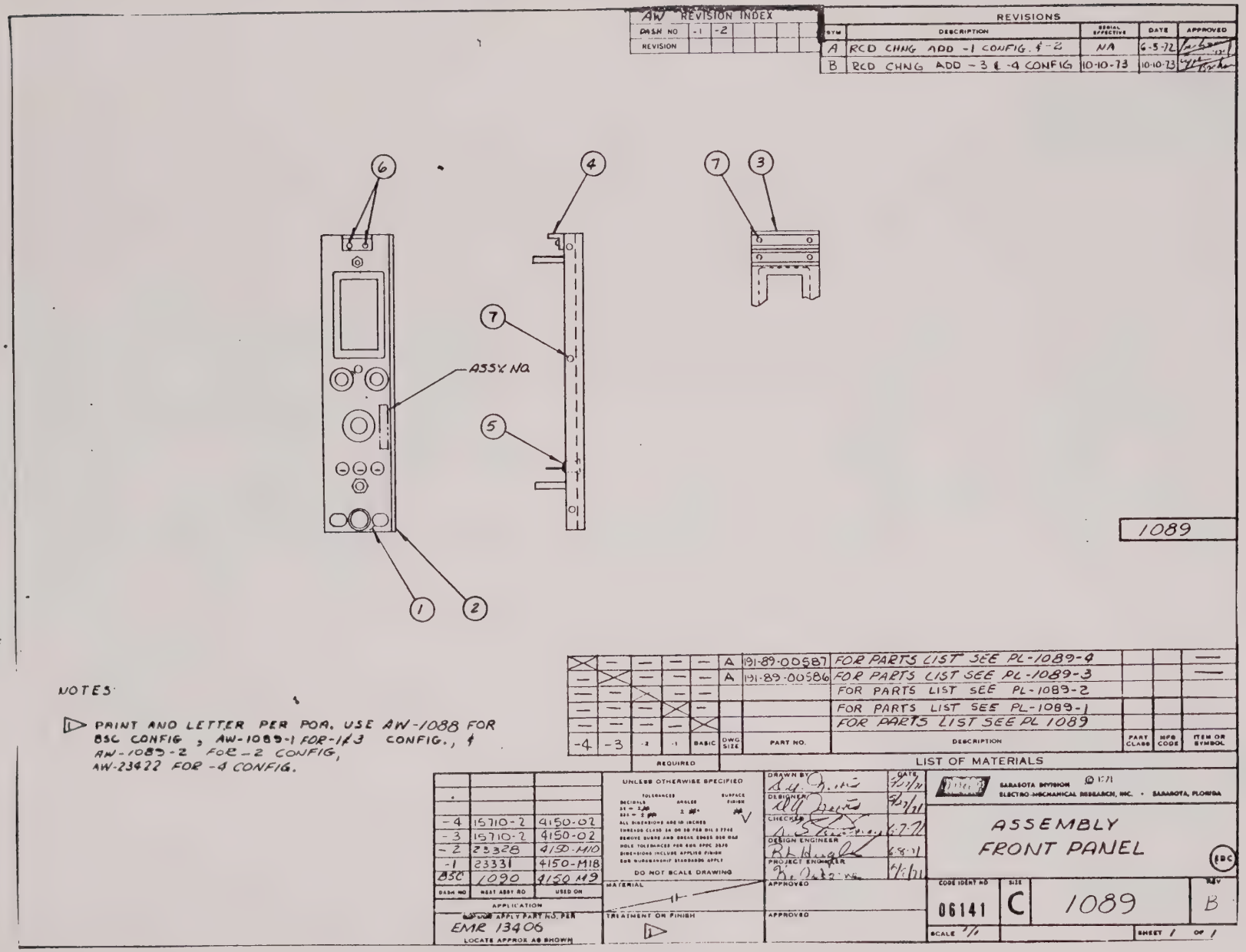


Figure 5-2. Front Panel Assembly Diagram

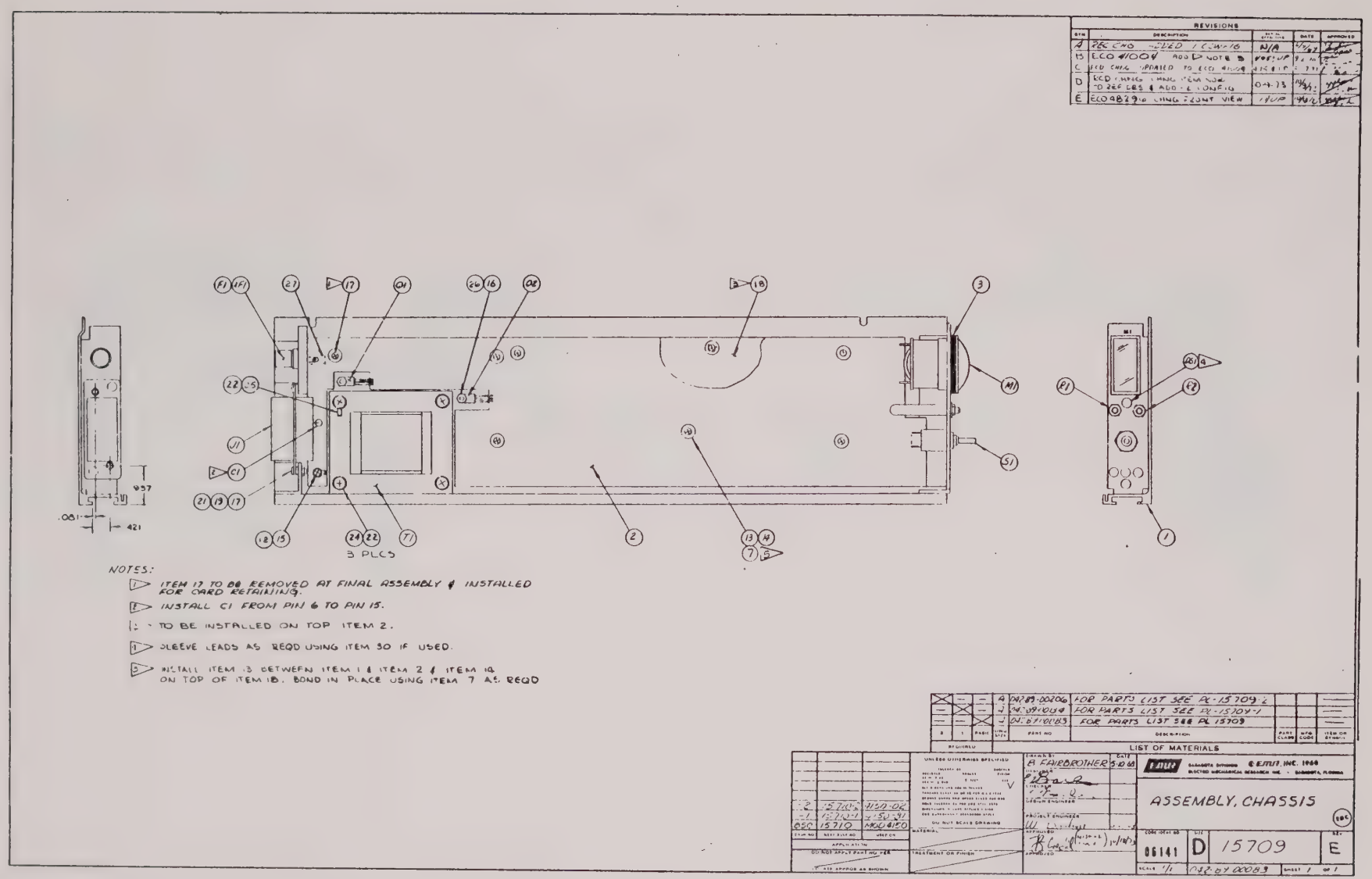


Figure 5-3. Chassis Assembly Diagram

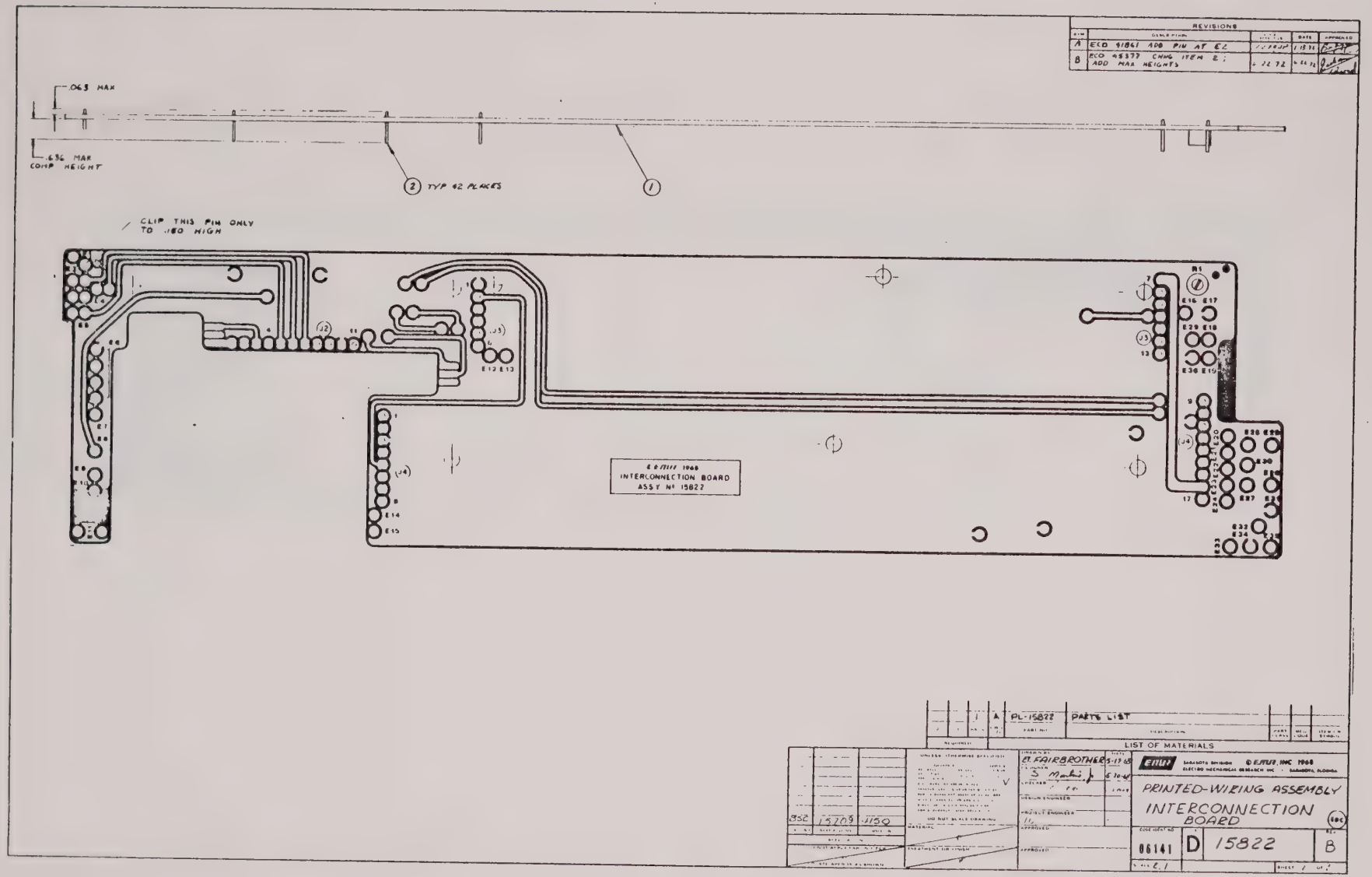


Figure 5-4. Interconnect Printed-Wiring Card Assembly Diagram

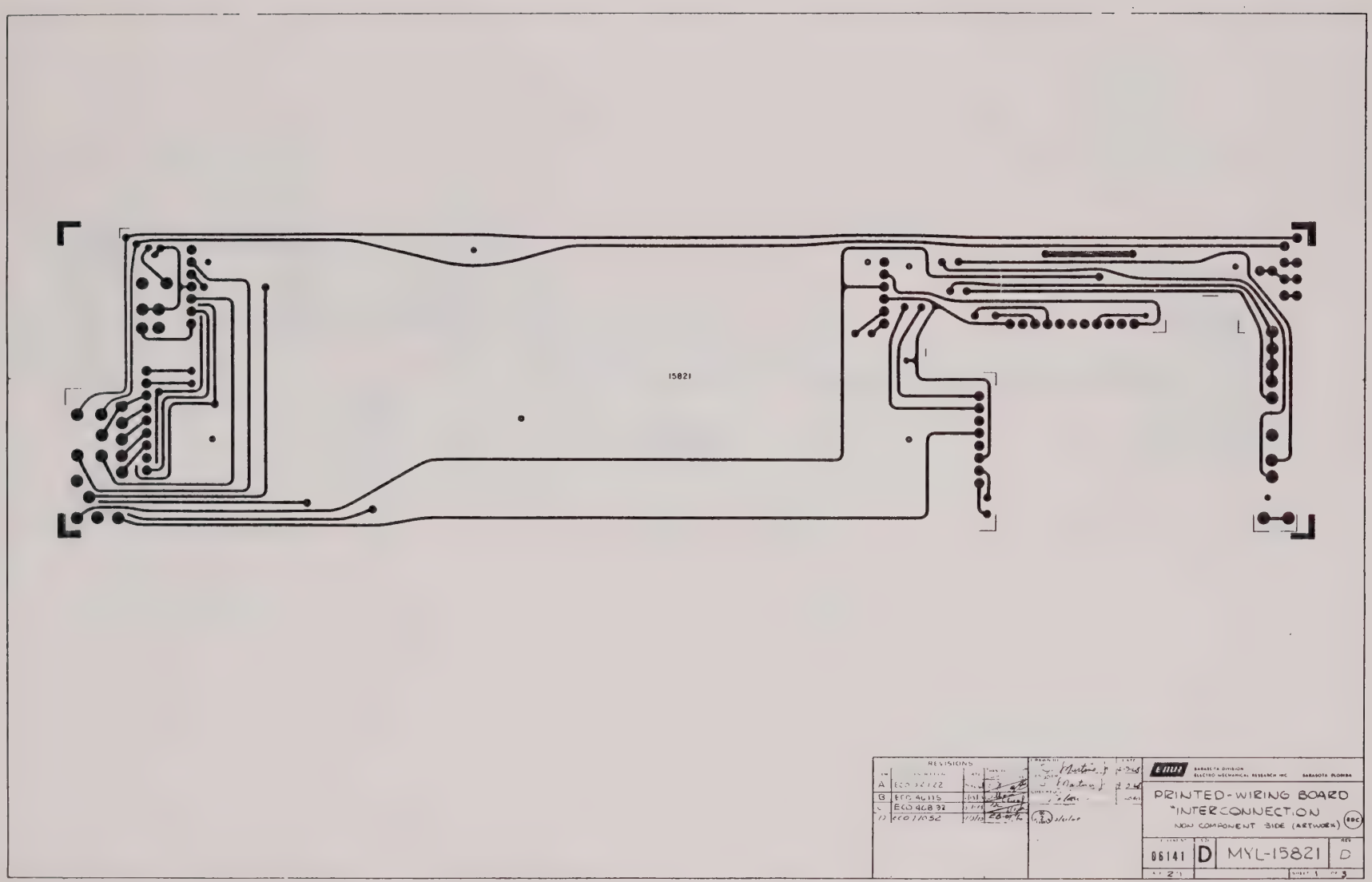


Figure 5-5 (1 of 2), Interconnect Printed-Wiring Card Wiring Diagram

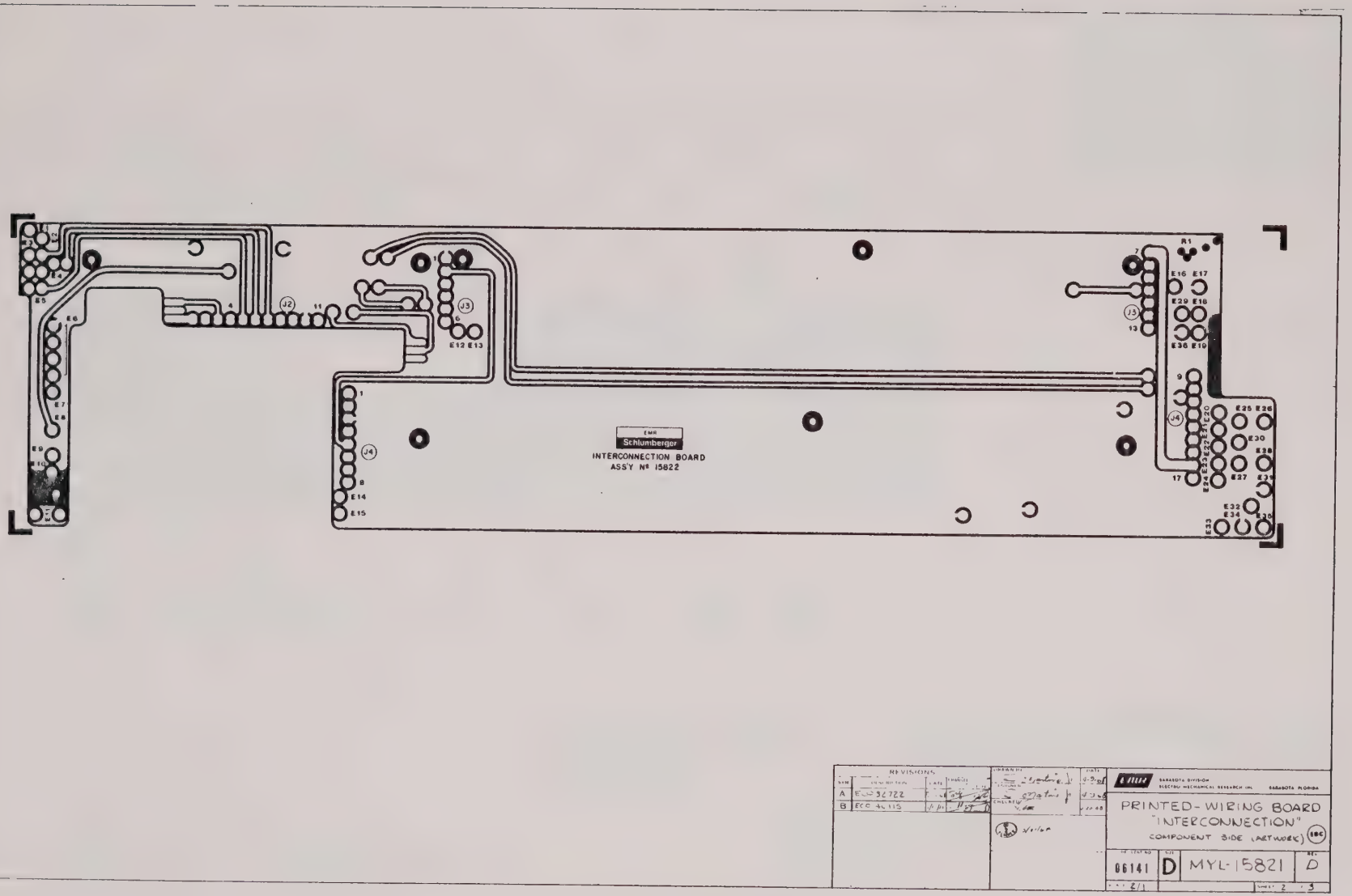


Figure 5-5 (2 of 2). Interconnect Printed-Wiring Card Wiring Diagram

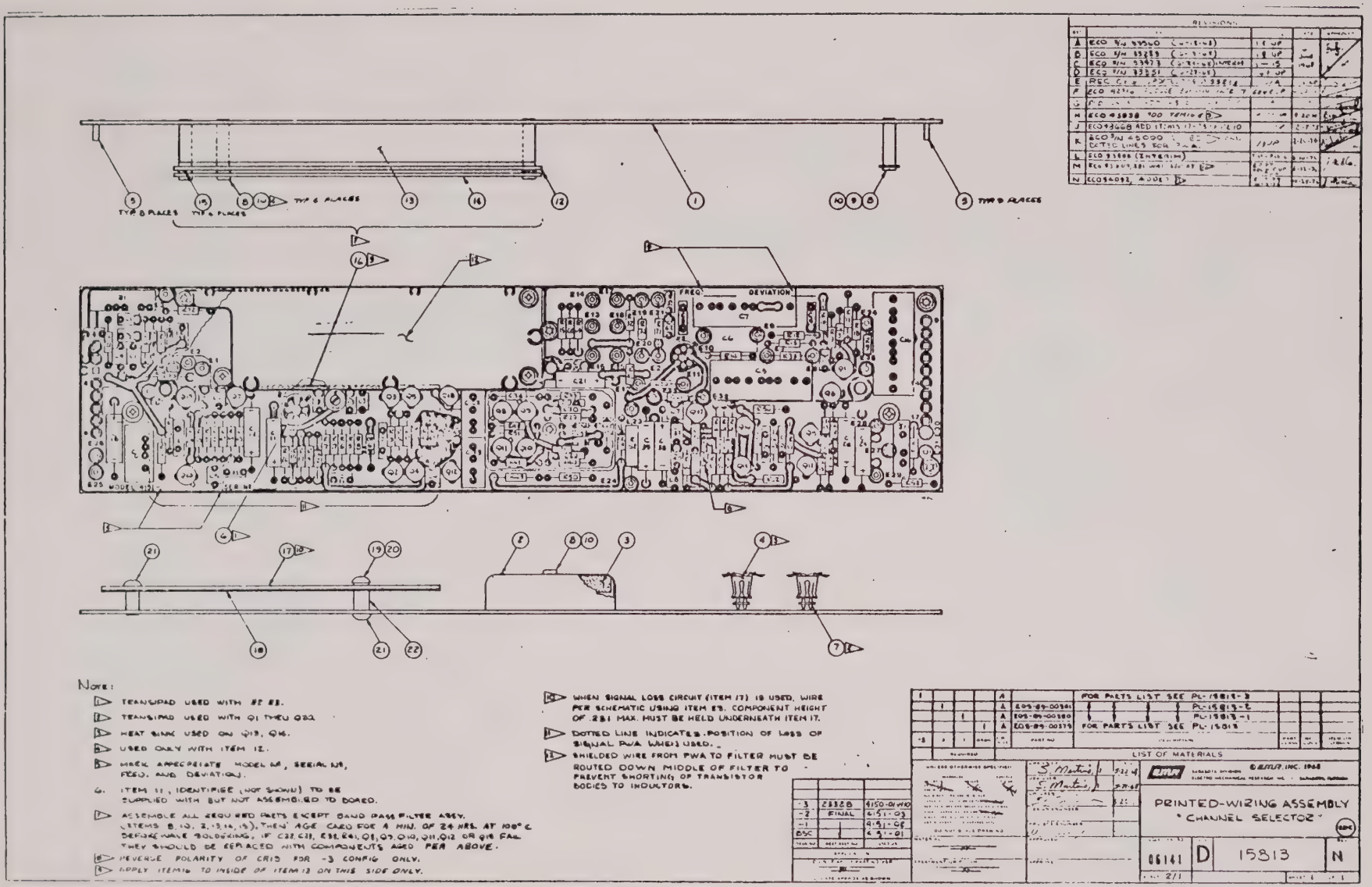

PRINTED-WIRING ASSEMBLY
"CHANNEL SELECTOR"
06141 D 15813 N
LIST OF MATERIALS
FOR PARTS LIST SEE PL-15813-3
FOR PARTS LIST SEE PL-15813
Note:
TRANSPAD USED WITH Q5 Q8.
TRANSPAD USED WITH Q1 THRU Q22.
HEAT SINK USED ON Q13, Q16.
USED ONLY WITH ITEM 12.
MARK APPROPRIATE MODEL NO., SERIAL NO., FREQ., AND DEVIATION.
ITEM 11, IDENTIFIER (NOT SHOWN) TO BE SUPPLIED WITH BUT NOT ASSEMBLED TO BOARD.
ASSEMBLE ALL REQUIRED PARTS EXCEPT BAND PASS FILTER ASSY. (ITEMS 8, 10, 2, 13, 14, 15), THEN AGE CARD FOR A MIN. OF 24 HRS. AT 100° C BEFORE WAVE SOLDERING. IF C37, C11, C31, C41, Q1, Q7, Q10, Q11, Q12 OR Q15 FAIL THEY SHOULD BE REPLACED WITH COMPONENTS AGED PER ABOVE.
REVERSE POLARITY OF CRYS FOR -3 CONFIG ONLY.
APPLY ITEM 16 TO INSIDE OF ITEM 13 ON THIS SIDE ONLY.
WHEN SIGNAL LOSS CIRCUIT (ITEM 17) IS USED, WIRE PER SCHEMATIC USING ITEM 23. COMPONENT HEIGHT OF .281 MAX. MUST BE HELD UNDERNEATH ITEM 17.
DOTTED LINE INDICATES POSITION OF LOSS OF SIGNAL PWA WHEN USED.
SHIELDED WIRE FROM PWA TO FILTER MUST BE ROUTED DOWN MIDDLE OF FILTER TO PREVENT SHORTING OF TRANSISTOR BODIES TO INDUCTORS.
FREQ
DEVIATION

Figure 5-6. Channel Selector Printed-Wiring Card Assembly Diagram, Model 4151

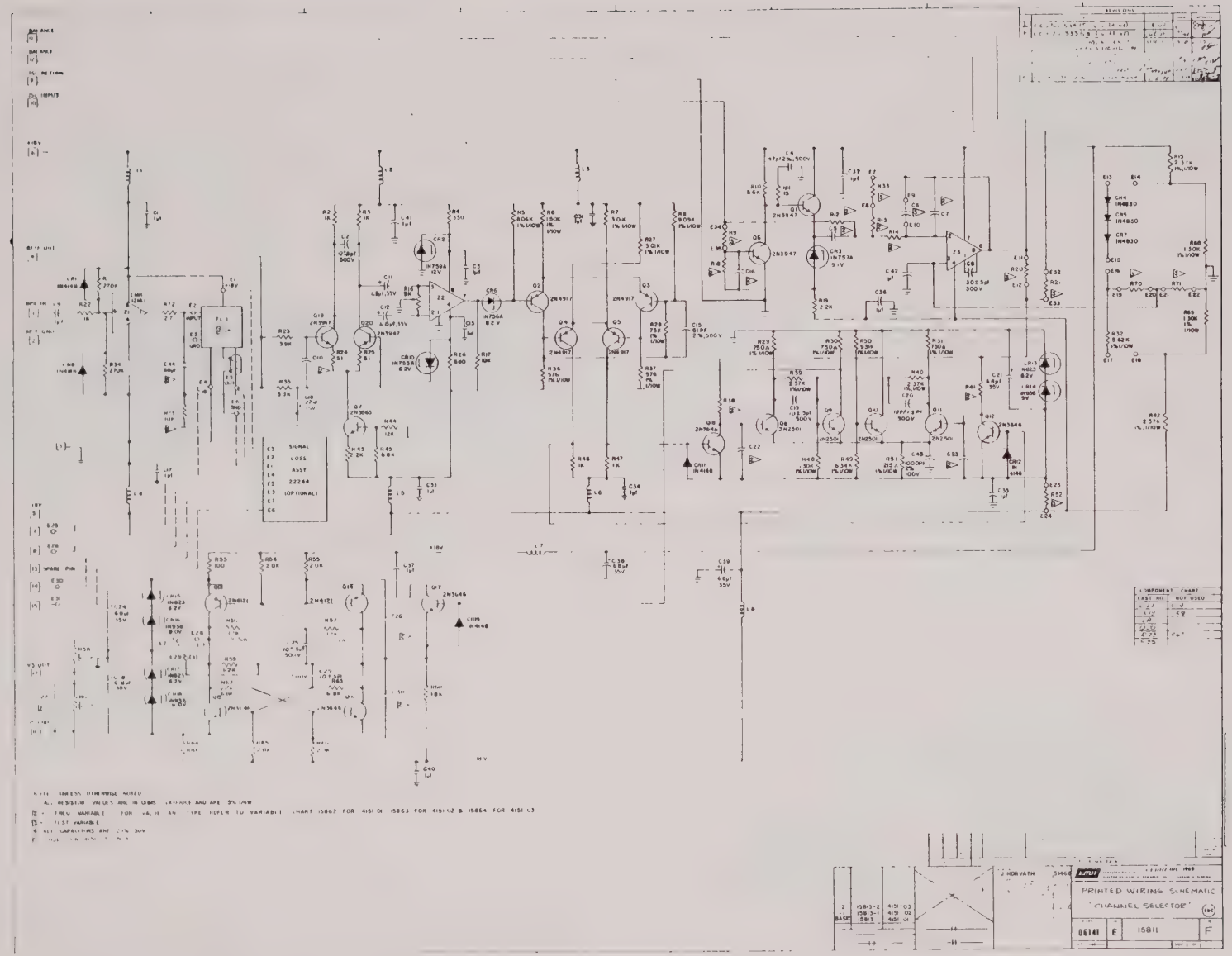


Figure 5-7. Channel Selector Printed-Wiring Card Schematic Diagram, Model 4151

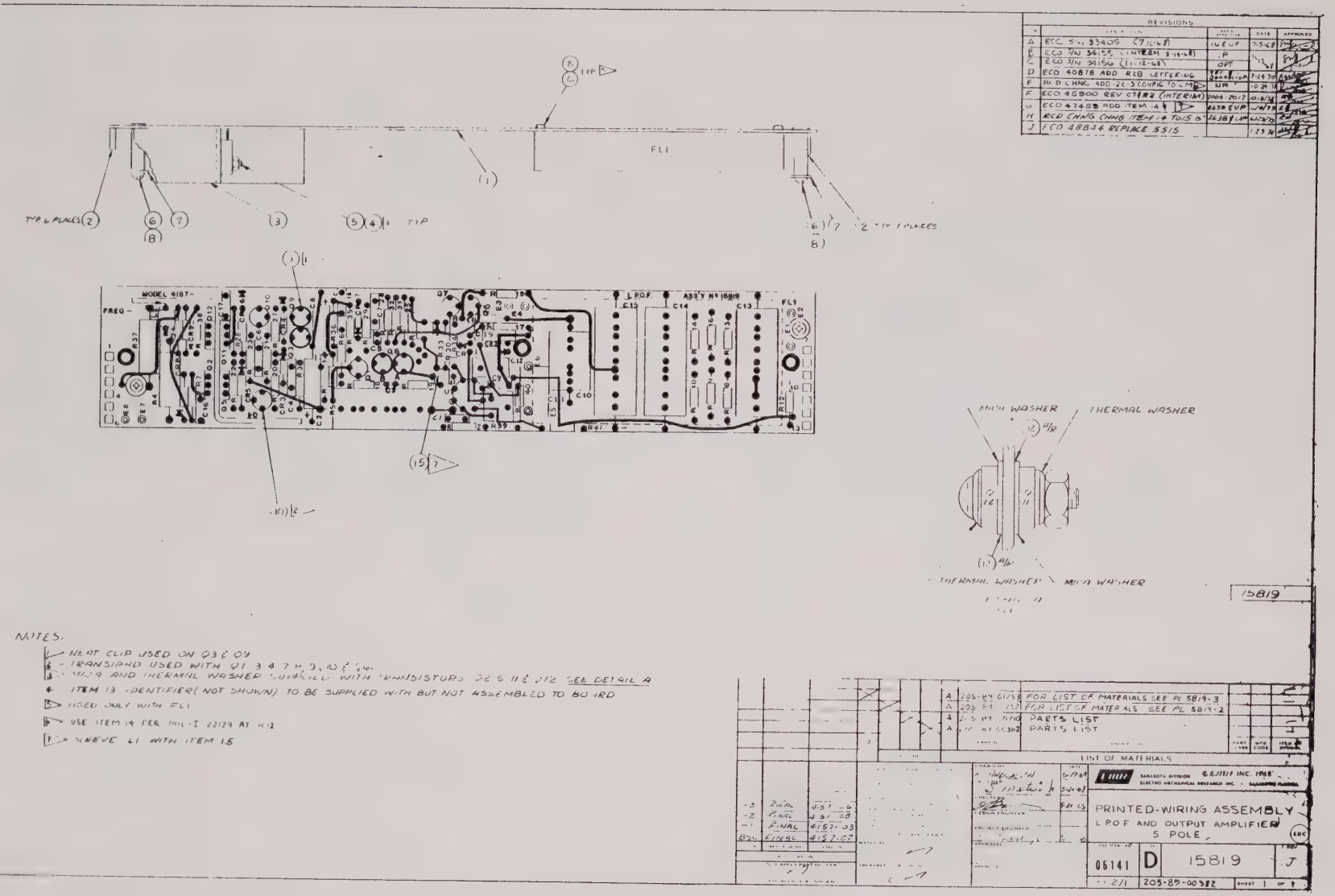

REVISIONS
A ECO S/N 33405 (7-16-68)
B ECO S/N 34155, (INTERIM 8-19-68)
C ECO S/N 34156 (11-12-68)
D ECO 40878 ADD R18 LETTERING
F R18 D CHNG, ADD 2C-3 CONFIG TO L.M.
F ECO 45900 REV C7822 (INTERIM)
G ECO 47453 ADD ITEM 14
H RED CHNG CHNG ITEM 16 TO IS
J ECO 48834 REPLACE 5515
MICA WASHER
THERMAL WASHER
THERMAL WASHER
MICA WASHER
15819
NOTES.
HEAT CLIP USED ON Q3 & Q4
TRANSPAD USED WITH Q1 3 4 7 8 9 AND 10
MICA AND THERMAL WASHER (UNLESS WITH TRANSISTORS 2 5 11 & 12 SEE DETAIL A
ITEM 13 IDENTIFIER (NOT SHOWN) TO BE SUPPLIED WITH BUT NOT ASSEMBLED TO BOARD
USED ONLY WITH FL1
USE ITEM 19 PER MIL-I 22129 AT K12
SCREW L1 WITH ITEM 15
FOR LIST OF MATERIALS SEE PL 5819-3
FOR LIST OF MATERIALS SEE PL 5819-2
PARTS LIST
PARTS LIST
LIST OF MATERIALS
PRINTED-WIRING ASSEMBLY
L P O F AND OUTPUT AMPLIFIER
5 POLE
06141
D
15819
J
205-89-00382

Figure 5-8. Low-Pass Output Filter and Output Amplifier Printed Wiring Card Assembly Diagram, Models 4157-05/-06 (frequencies>500Hz), 4157-02, and 4157-03

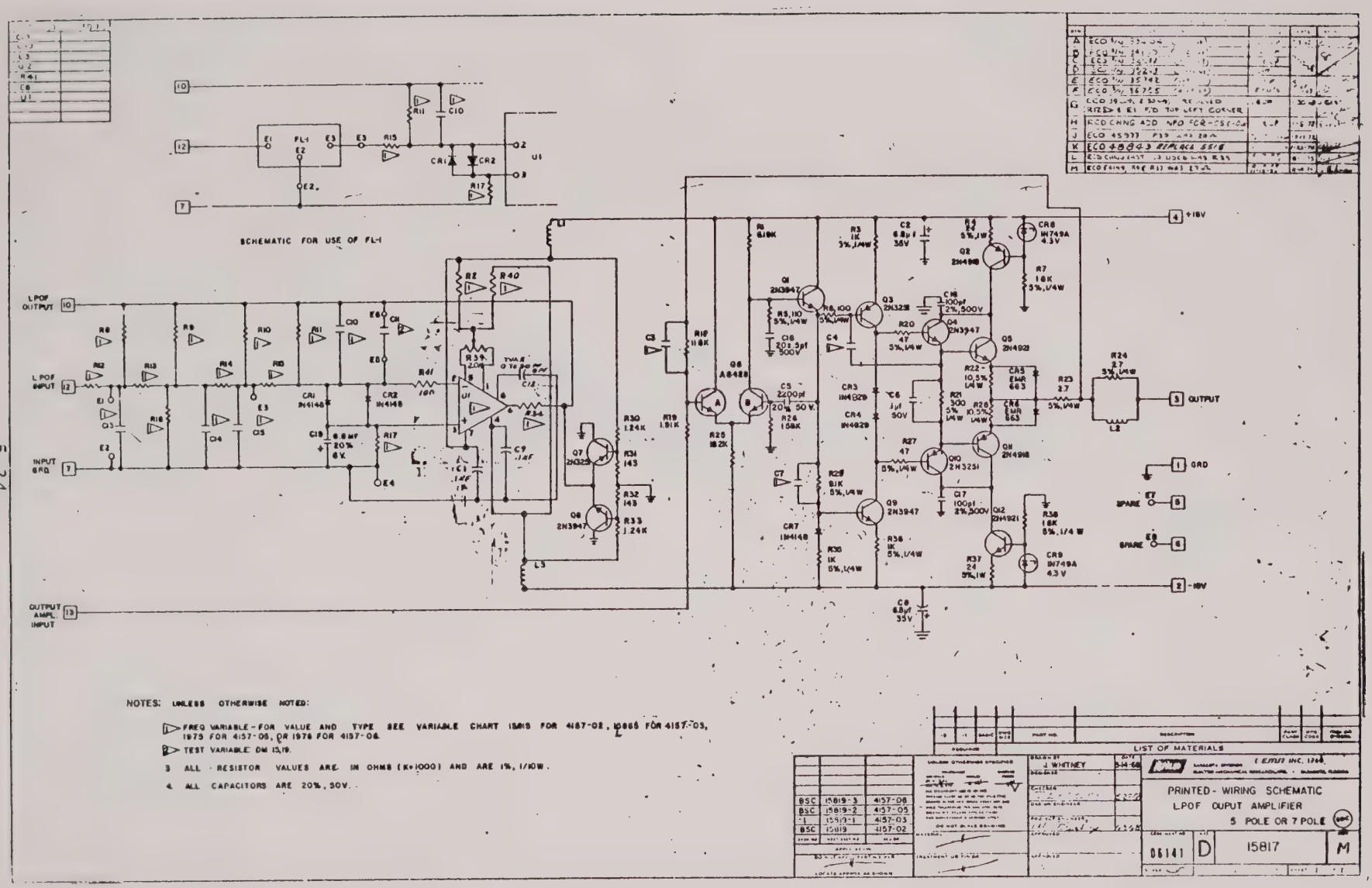


Figure 5-9. Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Schematic Diagram, Models 4157-05 and 4157-06 (frequencies > 500 Hz), 4150-02 and 4150-03

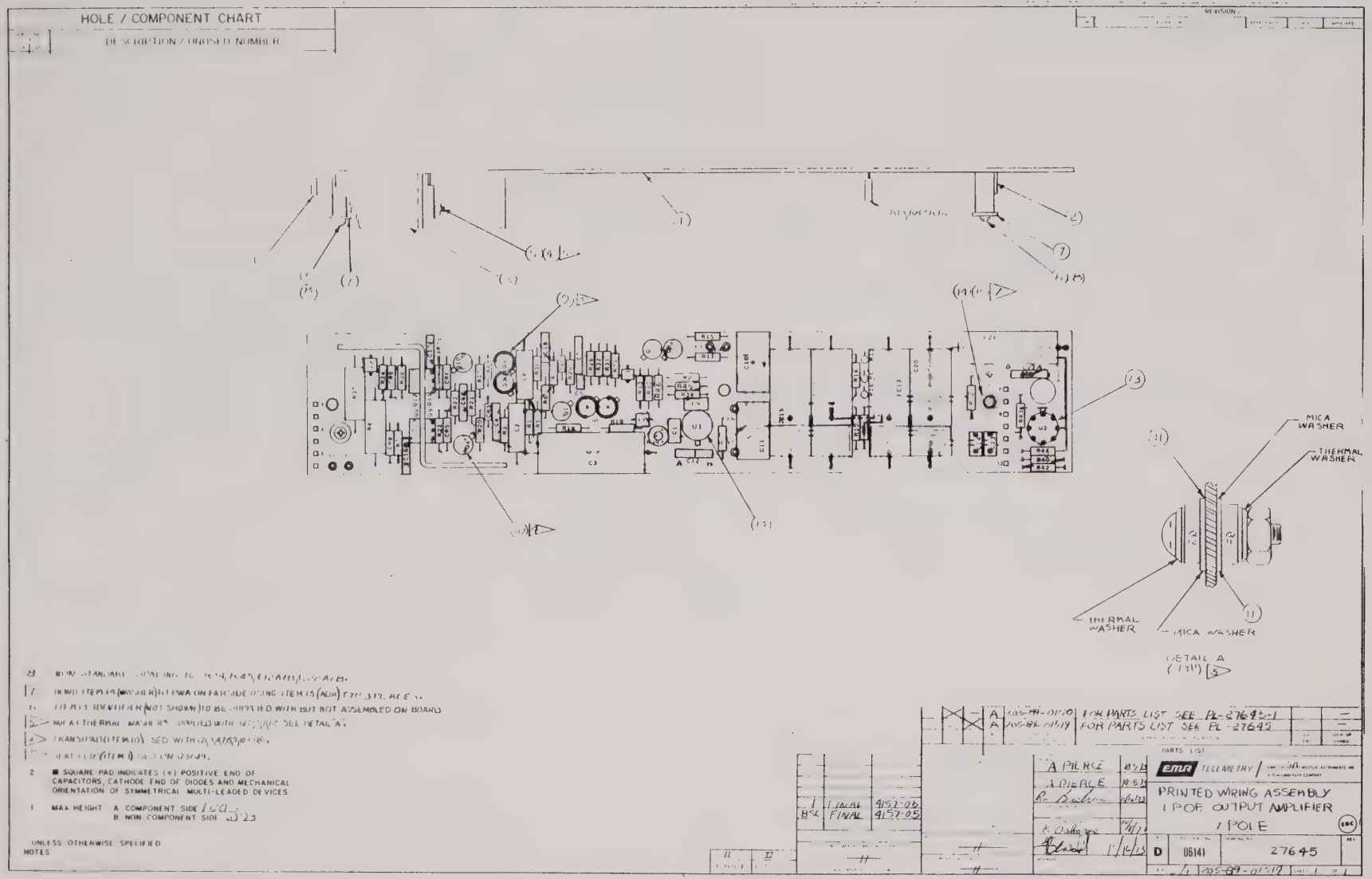


Figure 5-10. Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Assembly Diagram, Models 4157-05 and 4157-06 (frequencies $\leq$ 500 Hz)

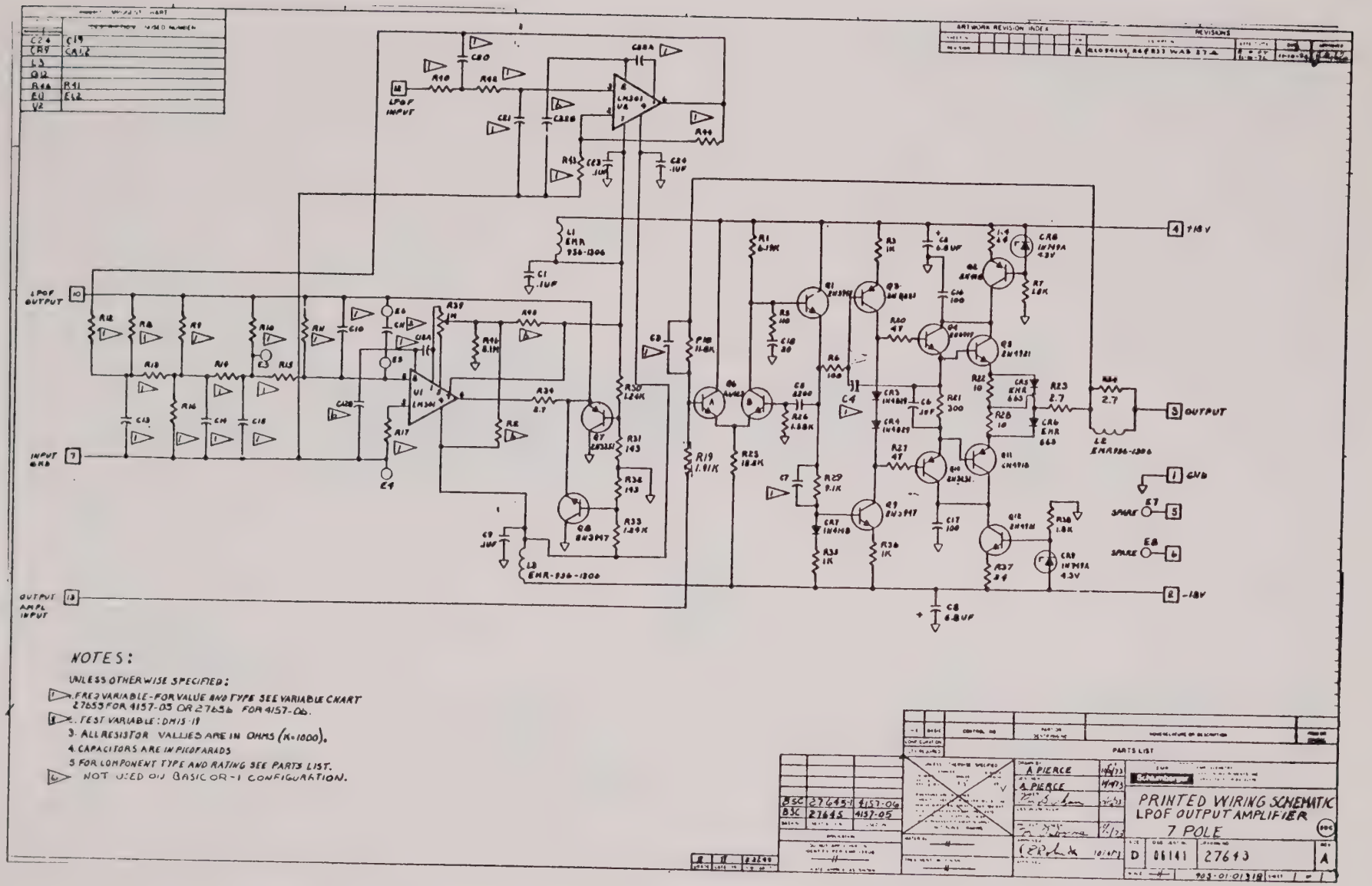


Figure 5-11. Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Schematic Diagram, Models 4157-05 and 4157-06 (frequencies $\leq$ 500 Hz)

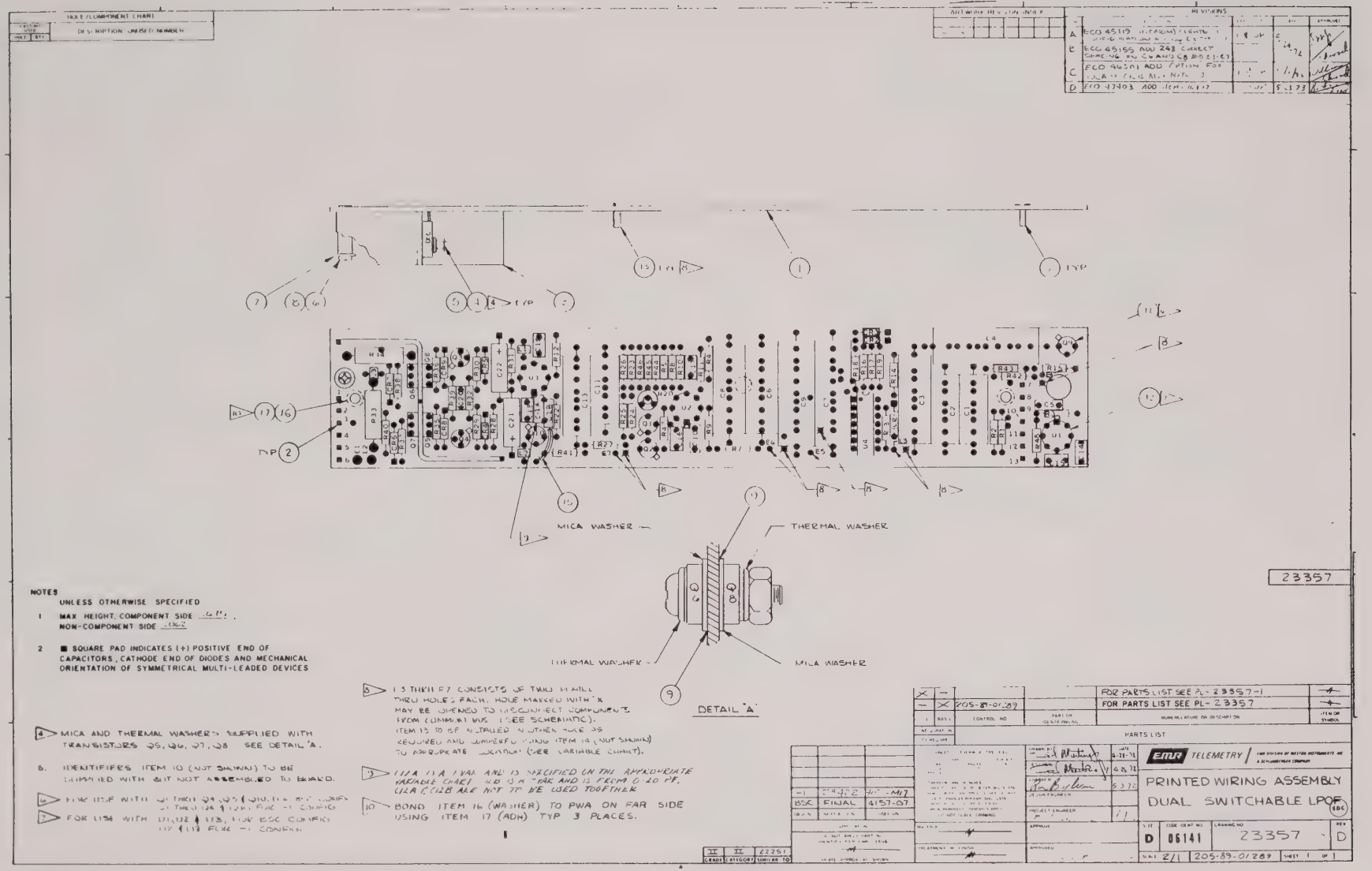
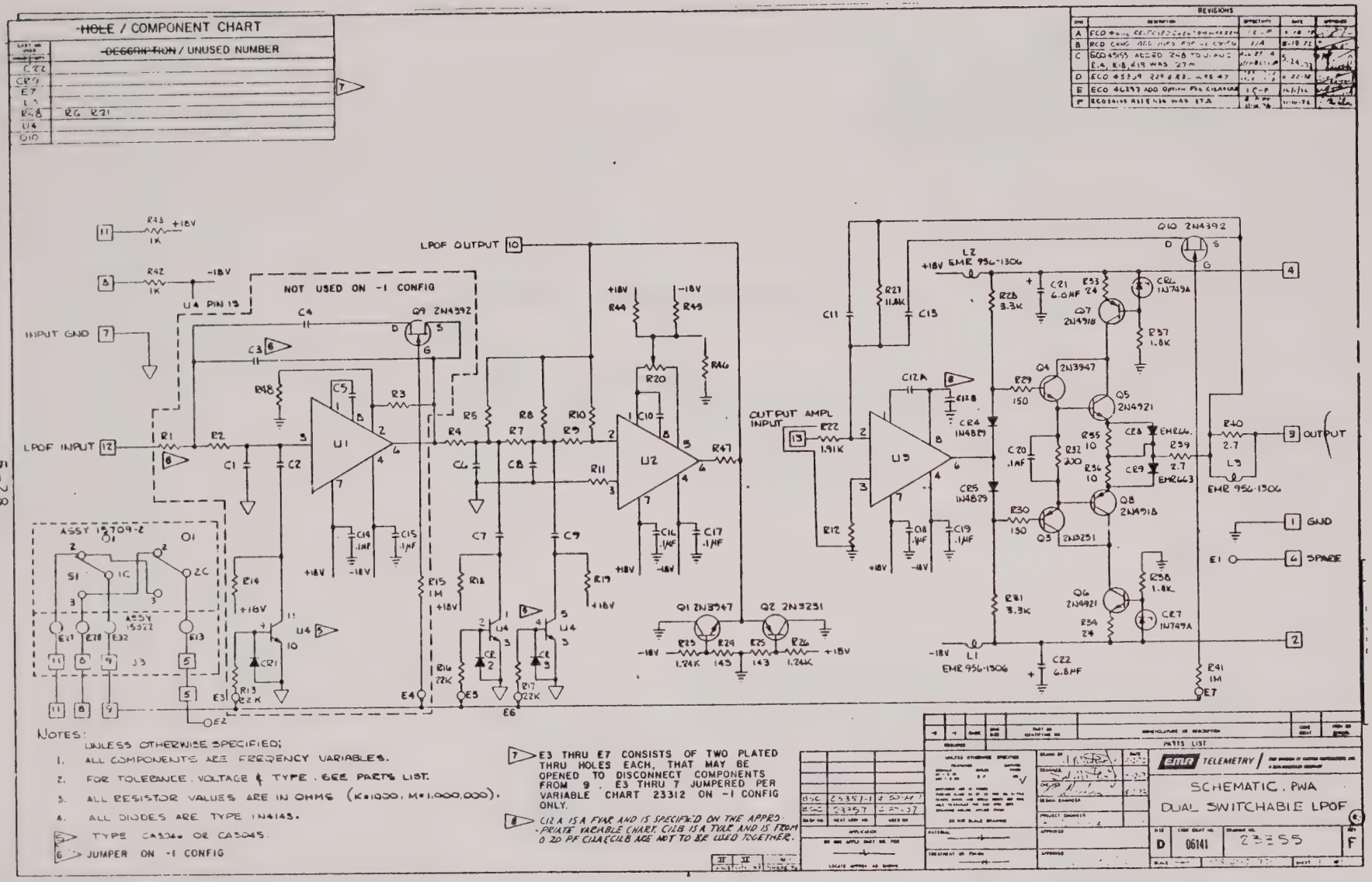

MICA WASHER
THERMAL WASHER
THERMAL WASHER
MICA WASHER
DETAIL "A"
NOTES
UNLESS OTHERWISE SPECIFIED
1 MAX HEIGHT, COMPONENT SIDE .6"; NON-COMPONENT SIDE .060"
2 ■ SQUARE PAD INDICATES (+) POSITIVE END OF CAPACITORS, CATHODE END OF DIODES AND MECHANICAL ORIENTATION OF SYMMETRICAL MULTI-LEADED DEVICES
4 MICA AND THERMAL WASHERS SUPPLIED WITH TRANSISTORS Q5, Q6, Q7, Q8 SEE DETAIL "A".
6 IDENTIFIES ITEM 10 (NOT SHOWN) TO BE SUPPLIED WITH BIT NOT ASSEMBLED TO BOARD.
8 I 3 THRU E7 CONSISTS OF TWO SMALL THRU HOLES EACH. HOLE MARKED WITH "X MAY BE DRILLED TO DISCONNECT COMPONENT FROM COMMON BUS (SEE SCHEMATIC). ITEM 15 TO BE INSTALLED IN OTHER HOLE AS REQUIRED AND JUMPERED USING ITEM 14 (NOT SHOWN) TO APPROPRIATE JUNCTION (SEE VARIABLE CHART).
9 C11A (1 A 1 VAR AND IS SPECIFIED ON THE APPROPRIATE VARIABLE CHART. "B" IS A "TAR AND IS FROM 0-20 PF. C11A & C11B ARE NOT TO BE USED TOGETHER
10 BOND ITEM 16 (WASHER) TO PWA ON FAR SIDE USING ITEM 17 (ADH) TYP 3 PLACES.
FOR PARTS LIST SEE PL- 23357-1
FOR PARTS LIST SEE PL- 23357
PARTS LIST
EMR TELEMETRY
PRINTED WIRING ASSEMBLY
DUAL SWITCHABLE LPOF
23357
205-89-01289

Figure 5-12. Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Assembly Diagram, Model 4157-07



NOTES:
UNLESS OTHERWISE SPECIFIED;
1. ALL COMPONENTS ARE FREQENCY VARIABLES.
2. FOR TOLERANCE, VOLTAGE & TYPE, SEE PARTS LIST.
3. ALL RESISTOR VALUES ARE IN OHMS (K=1000, M=1,000,000).
4. ALL DIODES ARE TYPE 1N4148.
5. TYPE CA3046 OR CA3045.
6. JUMPER ON -1 CONFIG
7. E3 THRU E7 CONSISTS OF TWO PLATED THRU HOLES EACH, THAT MAY BE OPENED TO DISCONNECT COMPONENTS FROM 9. E3 THRU 7 JUMPERED PER VARIABLE CHART 23312 ON -1 CONFIG ONLY.
8. C12A IS A FIXED AND IS SPECIFIED ON THE APPRO. PRIATE VARIABLE CHART. C12B IS A TRIM AND IS FROM 0 TO 20 PF. C12A&C12B ARE NOT TO BE USED TOGETHER.

Figure 5-13. Low-Pass Output Filter and Output Amplifier Printed-Wiring Card Schematic Diagram, Model 4157-07

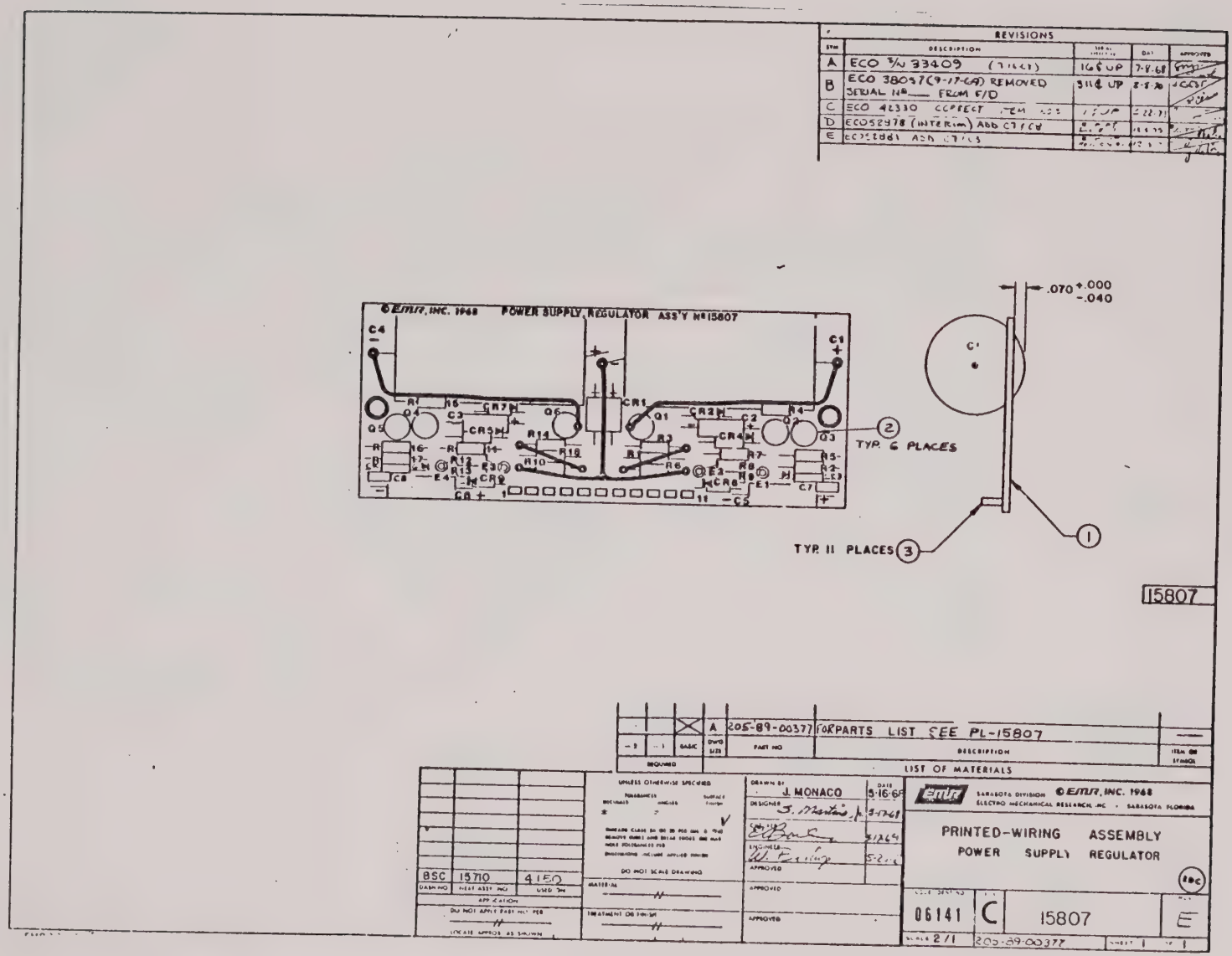


Figure 5-14. Power Supply/Regulator Printed-Wiring Card Assembly Diagram

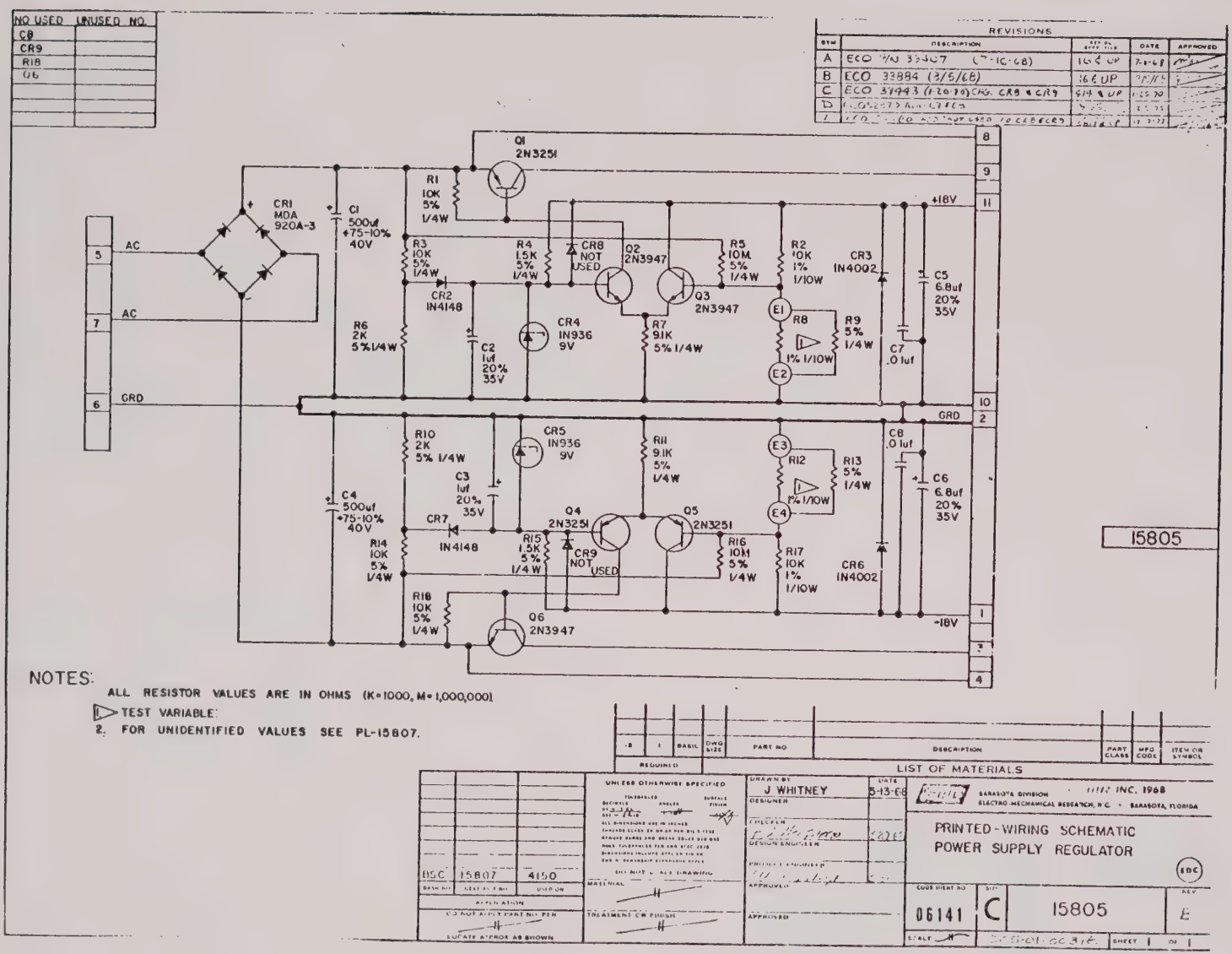
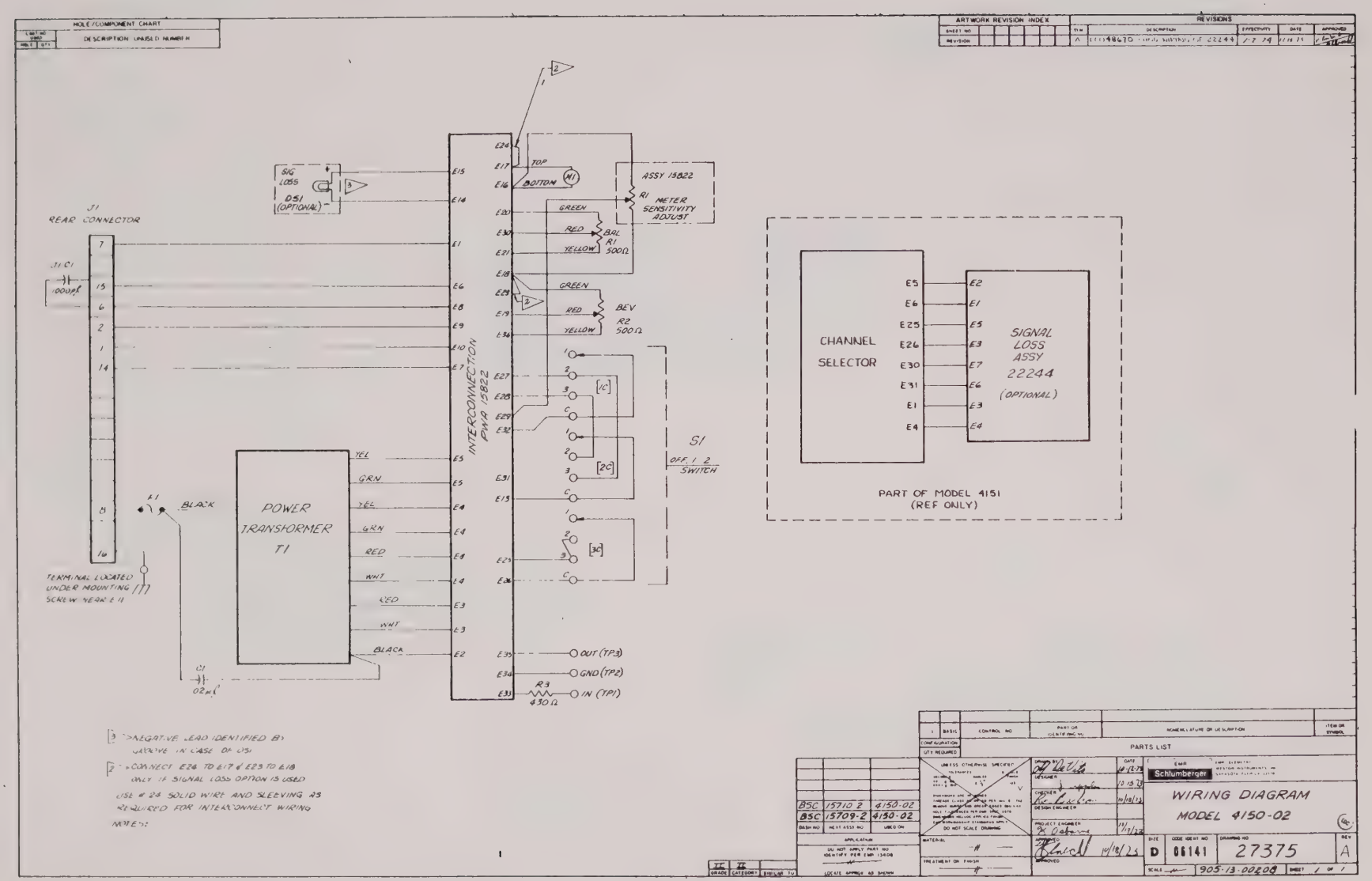


Figure 5-15. Power Supply/Regulator Printed-Wiring Card Schematic Diagram



[3] = NEGATIVE LEAD IDENTIFIED BY ARROW IN CASE OF DS1

[2] = CONNECT E24 TO E17 & E23 TO E18 ONLY IF SIGNAL LOSS OPTION IS USED

USE # 24 SOLID WIRE AND SLEEVING AS REQUIRED FOR INTERCONNECT WIRING

NOTES:

Figure 5-16. Wiring Diagram, EMR 4150-02

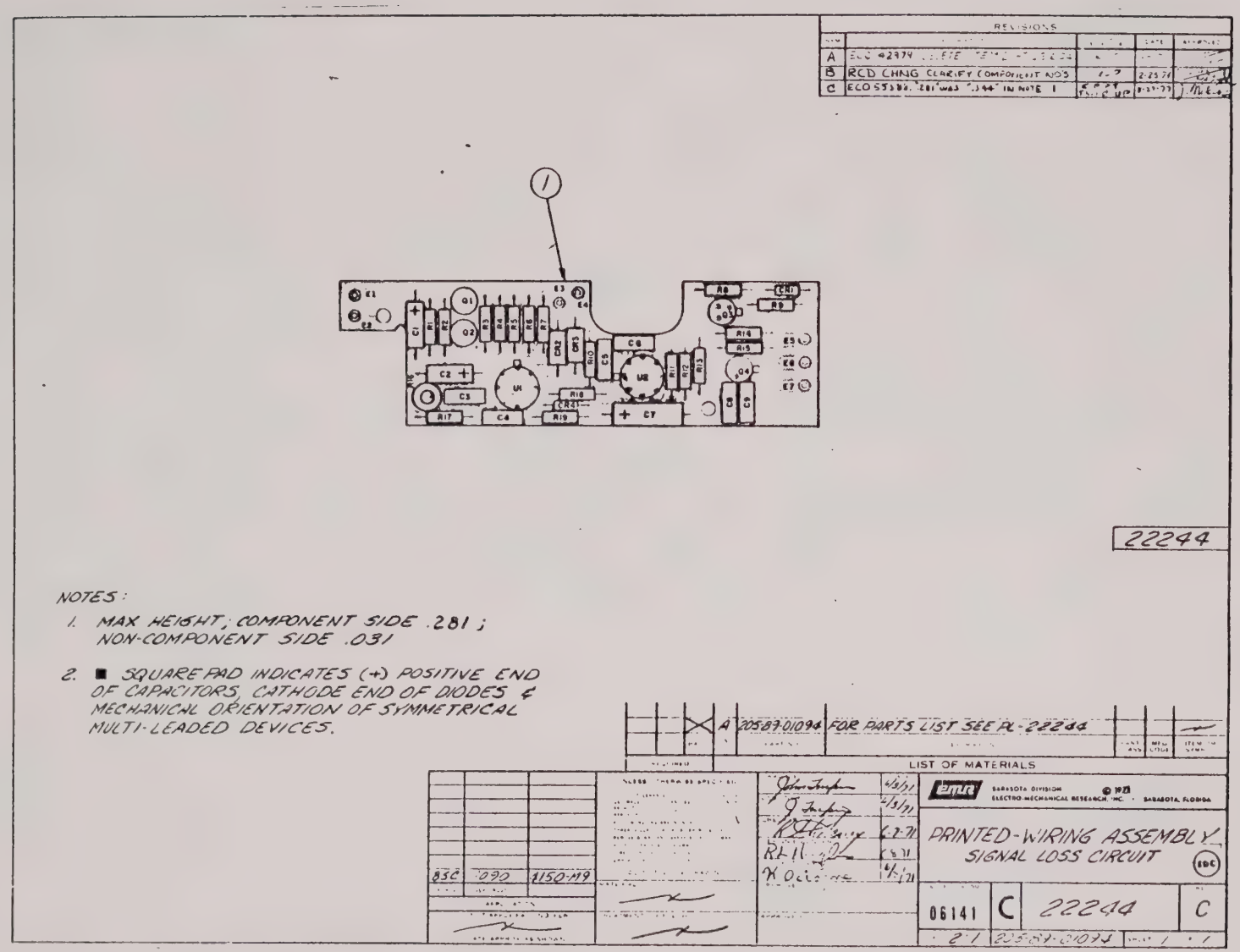

REVISIONS
A
B RCD CHNG CLARIFY COMPONENT NOS
C
NOTES:
1. MAX HEIGHT, COMPONENT SIDE .281 ;
NON-COMPONENT SIDE .031
2. ■ SQUARE PAD INDICATES (+) POSITIVE END OF CAPACITORS, CATHODE END OF DIODES & MECHANICAL ORIENTATION OF SYMMETRICAL MULTI-LEADED DEVICES.
22244
A 20587-01094 FOR PARTS LIST SEE A-22244
LIST OF MATERIALS
PRINTED-WIRING ASSEMBLY
SIGNAL LOSS CIRCUIT
06141 C 22244 C

Figure 5-17. Signal Loss Printed-Wiring Card Assembly Diagram (Optional)

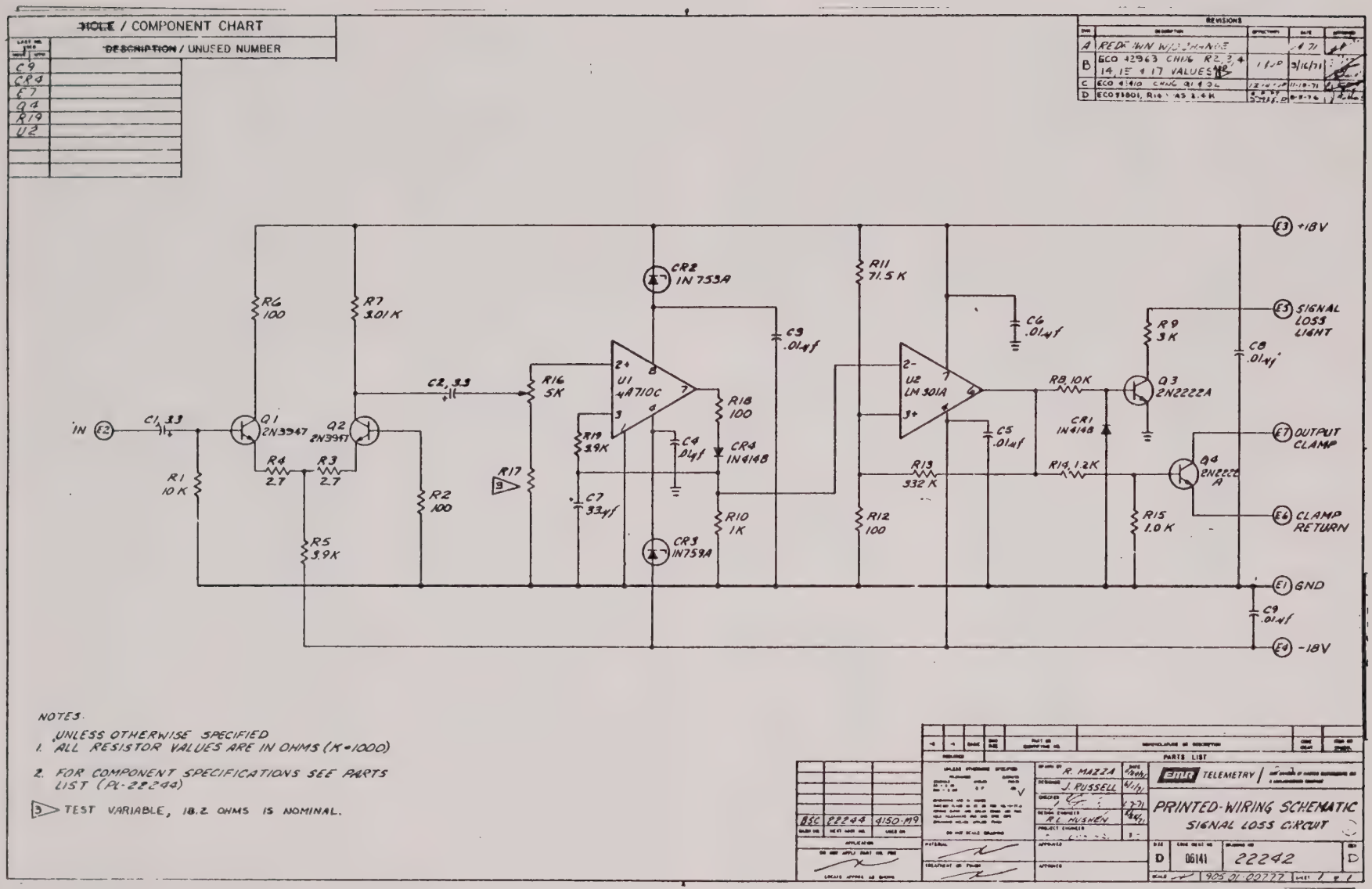


Figure 5-18. Signal Loss Printed-Wiring Card Schematic Diagram

SECTION 6

REPLACEABLE PARTS LIST AND RECOMMENDED SPARES LIST

6.1 GENERAL

This section contains information describing the replacement parts, recommended spares, spares provisioning, and ordering instructions for the EMR 4150-02 Subcarrier Discriminator. These items are discussed in separate major paragraphs of this section. Assembly diagrams to be used in conjunction with the parts lists are supplied in Section 5 of this manual.

6.2 REPLACEABLE PARTS LISTS

The replaceable parts lists for all assemblies of the 4150-02 are contained in Tables 6-1 through 6-18. Table 6-1 contains a master list of all major equipment in the 4150 and provides a breakdown of the assemblies within the 4150 equipments. The name of the models or assemblies is provided along with the EMR parts list number (assembly number), the figure in this manual that illustrates the model or assembly, the table number in this section that contains the parts breakdown, and the page number on which each parts list starts.

The individual parts list tables are computer prepared lists providing listings of all items and components on an assembly. These lists are keyed to the referenced assembly diagrams in Section 5 of this manual. Each item of the parts list is identified by an item number or component designation in the ITEM NO. column. The numbers or designations in this column correspond directly to the numbers in reference balloons on the associated assembly diagrams. The total quantity of an item or component on the assembly is listed in the QTY REQD column. The EMR NUMBER column contains the EMR assigned 10-digit number of all items. Any replacement item for an assembly may be obtained directly from EMR using this part number.

The DRAWING OR SPEC NO. column contains an EMR assembly drawing or specification number under which the item or component is manufactured or purchased. A complete description and proper name of the item or component is provided in the DESCRIPTION column. Figure 6-1 is the master variable chart for the 4150. This figure identifies the complete model number of the 4150 and contains parts information for the variable items.

6.3 RECOMMENDED SPARES LISTS

The recommended spares lists for the EMR 4150-02 equipments are contained in Tables 6-19 through 6-24. These tables provide a breakdown for each major model grouping. Table 6-19 is a list for the basic chassis and regulator which is part of all EMR 4150's. Subsequent lists are breakdowns for the various

cards installed in a 4150. These spares are based on a single unit. If several 4150's are included in a system, the total spares may be adjusted as desired. That is, the total number of spares need not be calculated in a 1:1 ratio based on the number of units in the system.

Also, the spares as listed in tables 6-20 through 6-24 are for one particular unit (or group of units). Therefore, if more than one of these plug-in cards are included on an order with a single 4150 chassis, the total number of spares may be adjusted as desired.

The recommended spares listed in the tables are based on the following conditions.

a. Operating Time -- 8 hours/day, 5 days/week (2080 hours/year).

b. Operating Temperature -- 0°C to 50°C.

c. User has capability to repair to the component level.

d. Failure rates are constant.

e. A 0.9 probability of being able to repair from the recommended complement for one year.

f. Equipment will be used as ground equipment (as opposed to vehicular or airborne).

6.4 PROVISIONING CONSIDERATIONS

The selection of an optimum spare parts complement involves a number of considerations known only to the user. These considerations include operating time and cycles, operating environment, number of equipments to be spared and their locations with respect to one another, urgency of returning an equipment to service, troubleshooting, repair and test capability, stock of commonly used parts, etc.

Sparing considerations known to EMR include mean-time-between-failures for parts and assemblies under various operating environments, prices, relative ease of troubleshooting, repair, retest, etc.

Table 6-25 lists the type of information required in order for EMR to recommend an optimum spare parts complement for specific operating and logistic situations. If the information outlined in Table 6-25 is supplied to EMR, a recommended list will be furnished at no cost for each individual situation.

6.5 ORDERING INSTRUCTIONS

When ordering parts or assemblies from EMR, the complete description of the part or assembly must accompany the order. Also included must be the EMR 10-digit number.

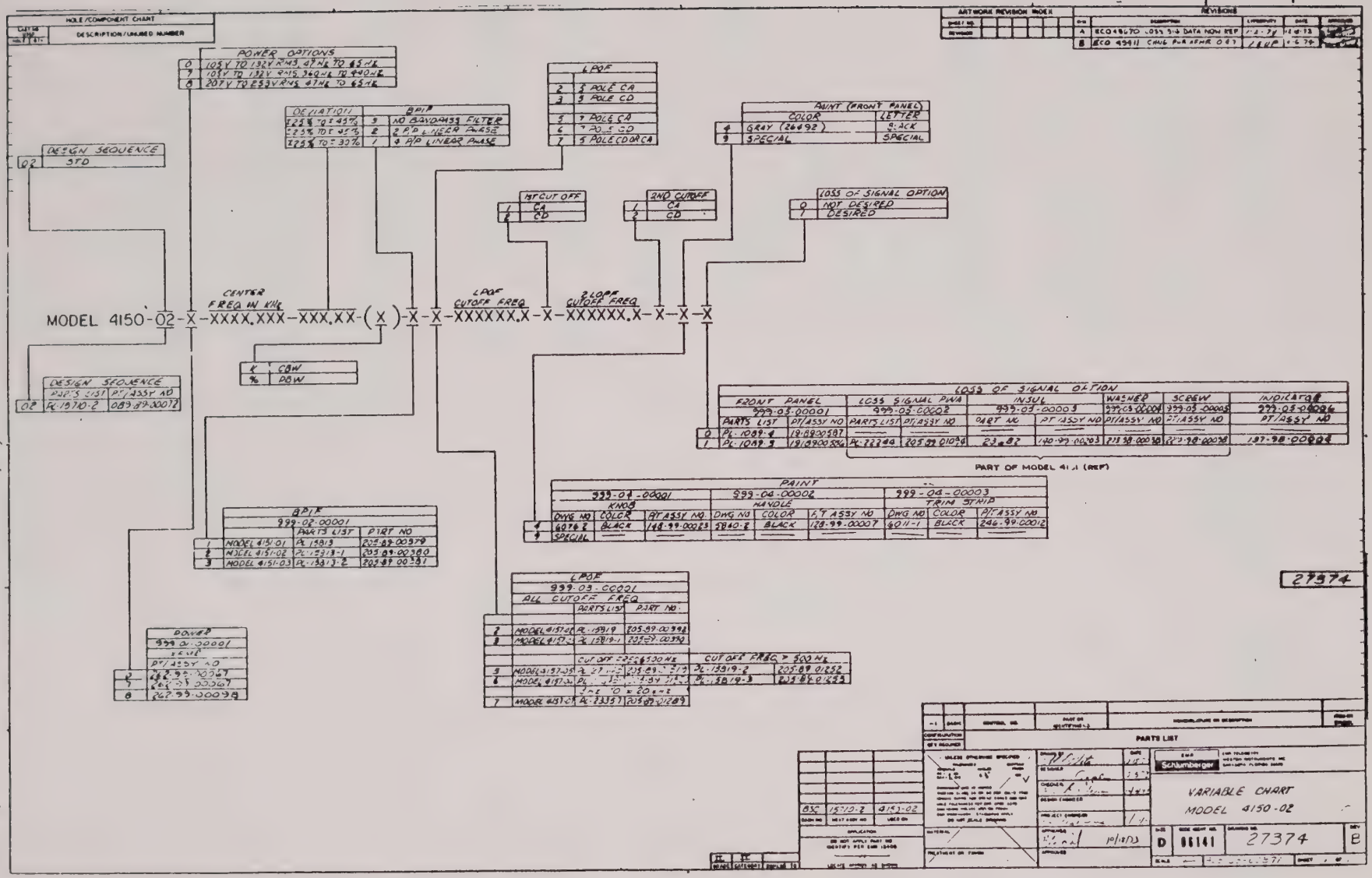


Figure 6-1. Top Assembly Variable Chart and Parts Information

Table 6-1. EMR 4150-02 Parts Lists

ASSEMBLY NAME	PARTS LIST NUMBER	TABLE NO.	PAGE NO.	FIG REF.
EMR 4150-02 Top Assembly Parts List	PL-15710-2	6-2	6-7	5-1
Front Panel Assembly Parts List (Without Signal Loss Option).	PL-1089-4	6-3	6-8	5-2
Front Panel Assembly Parts List (With Signal Loss Option)	PL-1089-3	6-4	6-9	5-2
Chassis Assembly Parts List	PL-15709-2	6-5	6-10	5-3
Interconnect Printed-Wiring Card Parts List	PL-15822	6-6	6-11	5-4
Model 4151-01 Channel Selector Printed-Wiring Card Parts Lists	PL-15813	6-7	6-12	5-6
Model 4151-02 Channel Selector Printed-Wiring Card Parts List	PL-15813-1	6-8	6-16	5-6
Model 4151 -03 Channel Selector Printed-Wiring Card Parts List	PL-15813-2	6-9	6-20	5-6
Model 4157-02 Low-Pass Output Filter Printed-Wiring Card Parts List	PL-15819	6-10	6-24	5-8
Model 4157-03 Low-Pass Output Filter Printed-Wiring Card Parts List	PL-15819-1	6-11	6-27	5-8
Model 4157-05 Low-Pass Output Filter Printed-Wiring Card Parts List (For frequencies $\leq$500Hz)	PL-27645	6-12	6-30	5-10
Model 4157-05 Low-Pass Output Filter Printed-Wiring Card Parts List (For frequencies>500Hz)	PL-15819-2	6-13	6-33	5-8

Table 6-1 (Cont'd), EMR 4150-02 Parts Lists

ASSEMBLY NAME	PARTS LIST NUMBER	TABLE NO.	PAGE NO.	FIG REF.
Model 4157-06 Low-Pass Output Filter Printed-Wiring Card Parts List (For frequencies ≤ 500Hz)	PL-27645-1	6-14	6-36	5-10
Model 4157-06 Low-Pass Output Filter Printed-Wiring Card Parts List (For frequencies > 500Hz)	PL-15819-3	6-15	6-39	5-8
Model 4157-07 Low-Pass Output Filter Printed-Wiring Card Parts List	PL-23357	6-16	6-42	5-12
Power Supply/Regulator Printed-Wiring Card Parts List	PL-15807	6-17	6-45	5-14
Signal Loss Printed-Wiring Card Parts List (Optional)	PL-22244	6-18	6-47	5-17

PARTS LIST 15710-2 REV DATE 02/09/78 REV LTR B
LIST TITLE DISCR,ASSY,SUBCARRIER CHGE CONT NO. CODE IDENT SHT 1 OF 1
PART NO. 089-89-00072 ECO 55822 06141 CKD BY Blaine

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION
1	1	042-89-00206	15709-2	CHAS,ASSY
2	1	999-05-00001	27374	PANEL,ASSY,FRONT*POA VAR*
3	1	999-04-00001	27374	KNOB *POA VAR*
4	1	999-04-00002	27374	HANDLE *POA VAR*
5	1	075-89-00012	6650	COVER,ASSY
6	1	295-89-00377	15807	PWA,REGULATOR
7	1	999-03-00001	27374	PWA *POA VAR*
8	1	999-02-00001	27374	PWA *POA VAR*
9	1	127-98-00008		GROM,NYLATCH,BLK,.162 SH
10	AR	287-02-00016		NUT,HEX,4-40 SST
11	AR	273-02-00046		WASHER,#4,FLAT,SS
12	AR	273-02-00025		WASHER,#4,INT TOOTH
13	AR	229-02-00073		SCREW,4-40X1/4 PAN HD
14	8	273-98-00048		WASHER,PHENOLIC .125 ID X
15	AR	229-02-00072		SCREW,4-40X3/16 PAN HD
16	AR	060-11-00001		CMPD,LOCKING,FINE THREAD
17	1	196-99-00156	10663	PLATE,NAME EQUIP IDENT
18	AR	268-98-00002		TUBING,3/16,THERM-FIT,WHT
19	AR	268-02-00046		TUBING,#22,EXTR TEF,WHT
20	1	140-99-00028	3241-2	INS, COVER
C 1	1	301-76-20301		CAP,CR , 500V .020 UF 20%
R 3	1	616-02-43009		RES. 430 OHM 5% 1/4W
REF 1	1	905-05-00371	27374	VAR CHART,MODEL 4150-02
REF 2	1	905-13-00208	27375	WIRING DIAGRAM
REF 3	1	905-07-00262	27382	SPEC,PRODUCT,MOD 4150-02

FIRST USAGE MODEL 4150-02

Table 6-3.

E M R - T E L E M E T R Y

PARTS LIST 1089-4 REV DATE 04/16/76 REV LTR A

LIST TITLE PANEL,ASSY,FRONT CHGE CONT NO. CODE IDENT SHT 1 OF 1
PART NO. 191-89-00587 ECO RECORD 1 06141 CKD BY

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	191-89-00239	15703	PANEL,ASSY,FRONT	EMR	191-89-00239	
2	1	999-04-00003	27374	STRIP *POA VAR*			
3	2	412-99-00007	15718	IDENT,RET	EMR	412-99-00007	
4	1	016-99-00041	6012	BRKT, LOCATING	EMR	016-99-00041	
5	3	143-98-00006		JACK,TEST PT,PNL TYPE,WHT	MML 16	016-8010-209	* P
6	2	229-98-00157		SCREW,DR,RND HD, 0X3/16	PRCMT OPTION	BY DESCRIPTION	
7	7	229-98-00155		SCREW,DR,RND HD,00X3/16	PRCMT OPTION	BY DESCRIPTION	
REF 1	1	905-10-00514	AW-23422	AW,PANEL,FRONT	EMR	905-10-00514	
REF 2	1	905-05-00371	27374	VAR CHART,MODEL 4150-02	EMR	905-05-00371	

FIRST USAGE MODEL 4150-02

Table 6-4. EMR - TELEMETRY

PARTS LIST 1089-3 REV DATE 04/16/76 REV LTR

LIST TITLE PANEL,ASSY,FRONT CHGE CONT NO. CODE IDENT SHT 1 OF |
PART NO. 191-89-00586 ECO RECORD 1 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	191-89-00588	1088	PANEL,SUBASSY,FRONT	EMR	191-89-00588	
2	1	999-04-00003	27374	STRIP,*POA VAR*			
3	2	412-99-00007	15718	IDENT,RET	EMR	412-99-00007	
4	1	016-99-00041	6012	BRKT, LOCATING	EMR	016-99-00041	
5	3	143-98-00006		JACK,TEST PT,PNL TYPE,WHT	MML 16	016-8010-209	* P
6	2	229-98-00157		SCREW,DR,RND HD, 0X3/16	PRCMT OPTION	BY DESCRIPTION	
7	7	229-98-00155		SCREW,DR,RND HD,00X3/16	PRCMT OPTION	BY DESCRIPTION	
REF 1	1	905-10-00513	AW-1089-1	AW,PANEL,FRONT	EMR	905-10-00513	
REF 2	1	905-05-00371	27374	VAR CHART,MODEL 4150-02	EMR	905-05-00371	

FIRST USAGE MODEL 4150-02

Table 6-5. E M R - T E L E M E T R Y

PARTS LIST 15709-2 REV DATE 04/14/77 REV LTR A

LIST TITLE CHAS,ASSY CHGE CONT NO. CODE IDENT SHT 1 OF 1
PART NO. 042-89-00206 ECO 54739 06141 CKD BY

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	042-89-00205	15707-1	CHAS,ASSY,WELDMENT	EMR	042-89-00205	
2	1	205-89-00383	15822	PWA,INTERCONNECTION	EMR	205-89-00383	
3	1	284-99-00009	15705	RET,METER	EMR	284-99-00009	
7	AR	060-11-00010		CMPD,ADHESIVE,FAST SET	EASTMAN	910	
12	1	255-98-00050		TERM,LUG,SOLDER,#6 SCREW	SHAKEPROOF	2522-06-00	
13	9	273-98-00036		WASHER,#8,FIBRE .188ID	SEASTROM	5602-82-093	
14	8	273-98-00035		WASHER,#8,FIBRE .175ID	SEASTROM	5602-79-062	
15	AR	229-02-00072		SCREW,4-40X3/16 PAN HD	PRCMT OPTION	MS51957-12	* P
16	AR	287-02-00016		NUT,HEX,4-40 SST	QVL	NAS 671-C4	
17	AR	229-02-00073		SCREW,4-40X1/4 PAN HD	PRCMT OPTION	MS51957-13	* P
18	1	140-99-00059	15722	INS,CHASSIS	EMR	140-99-00059	
19	AR	287-02-00016		NUT,HEX,4-40 SST	QVL	NAS 671-C4	
20	AR	273-02-00004		WASHER,#4, FLT ST STL	PRCMT OPTION	MS15795-803	
21	AR	273-02-00024		WASHER,#2,INT TOOTH	PRCMT OPTION	MS35333-69	
22	AR	229-02-00106		SCREW,8-32X7/8 PAN HD	PRCMT OPTION	MS51957-48	* P
24	AR	273-02-00027		WASHER,#8,INT TOOTH	PRCMT OPTION	MS35333-72	
25	1	255-98-00064		TERM,SOLDER LUG,.144ID	ZIERICK	409 #6 BRASS OR BRONZE	
26	AR	273-02-00046		WASHER,#4,FLAT,SS	QVL	NAS620C4	
27	AR	268-98-00013		TUBING,.750ID,SHRINK	ALPHA WIRE	FIT-105-3/4*BLACK*	
28	AR	276-99-00009	619-24	WIRE,#24,BUSS,SOLID	EMR	276-99-00009	
29	AR	268-02-00049		TUBING,#24,EXTR TEF,CLEAR	PRCMT OPTION	MIL-I-22129	
30	AR	268-02-00058		TUBING,#24,EXTR TEF,WHT	QVL	MIL-I-22129	
C 1	1	304-62-10000	600	CAP. 1000PF 1% 100V	EMR	304-62-10000	
DS 1	1	999-05-00006	27374	IND *POA VAR*			
F 1	1	120-98-00038		FUSE,MICRO,1 AMP 125V	LITTELFUSE	273001	
J 1	1	063-98-00042		CONN,PLUG,16PIN,R&P	AMPHENOL	26-159-16	
M 1	1	170-99-00043	15252-1	METER,EDGW,BANDEDGE	EMR	170-99-00043	
Q 1	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 2	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	201-98-00247		POT,TRMR,500 OHM 10%.75W	BECKMAN	78LR500BW	* Q
R 2	1	201-98-00247		POT,TRMR,500 OHM 10%.75W	BECKMAN	78LR500BW	
S 1	1	250-89-00018	8009-2	SWITCH RGT 3 P/2-3 POS	EMR	250-89-00018	
T 1	1	999-02-00001	27374	XFMR *POA VAR*			
XF 1	1	134-98-00023		HOLDER,FUSE 5A FR PNL MT	LITTELFUSE	281006	
REF 1	1	905-05-00371	27374	VAR CHART,MODEL 4150-02	EMR	905-05-00371	
REF 2	1	905-13-00208	27375	WIRING DIAGRAM	EMR	905-13-00208	

FIRST USAGE MODEL 4150-02

Table 6-6. E M R - T E L E M E T R Y

PARTS LIST 15822 REV DATE 08/20/77 REV LTR. D

LIST TITLE PWA,INTERCONNECTION CHGE CONT NO. CODE IDENT SHT 1 OF 1
PART NO. 205-89-00383 ECO RECORD 1 06141 CKD BY

ITEM NO.		QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
	1	1	204-99-00300	15821	PWB,INTERCONNECTION	EMR	204-99-00300	
	2	42	065-98-00045		CONT,PIN,.025SQ, .620L	BERG ELECT	75481-014	
R	1	1	201-98-00093		POT,TRMR, 5.0 K 10% .5W	BECK/MML27	62PR5K	* K

FIRST USAGE MODEL 4150

Table 6-7. E M R - T E L E M E T R Y

PARTS LIST 15813 REV DATE 09/02/76 REV LTR T

LIST TITLE PWA,CHANNEL SELECTOR CHGE CONT NO. CODE IDENT SHT 1 OF 4
PART NO. 205-89-00379 ECO 53810 06141 CKD BY

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	204-89-00165	15812	PWB,CHANNEL SELECTOR	EMR	204-89-00165	
2	1	232-99-00001	5337	SHIELD	EMR	232-99-00001	
3	1	140-99-00006	5211	INS	EMR	140-99-00006	
4	2	298-98-00007		HTSK,FAN TOP	IERC	TXC-208 OR TXC-20U	
5	17	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
6	2	189-98-00011		PAD,XSTR,TO-5 8PIN,.075H	MILTON ROSS	10193-DAP	
7	20	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
8	AR	229-02-00066		SCREW,2-56X5/16 PAN HD	PRCMT OPTION	MS51957-4	* P
9	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
10	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
11	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
12	AR	999-01-00015	15862	FIL, *FREQ VAR*			
13	AR	999-01-00016	15862	SHIELD, *FREQ VAR*			
14	1	232-99-00018	15724	SHIELD,FILTER CARD	EMR	232-99-00018	
15	3	273-98-00038		WASHER,FIBRE,.10 IDX.190	SEASTROM	5602-55-32	
16	AR	252-98-00019		TAPE,GLASS CLOTH,3/8 WIDE	3M	27/BY DESCRIPTION	
17	1	999-05-00002	14519	PWA, *POA VAR*			
18	1	999-05-00003	14519	INSUL,*POA VAR*			
19	AR	999-05-00004	14519	WASHER,*POA VAR*			
20	AR	999-05-00005	14519	SCREW,*POA VAR*			
21	2	229-98-00098		SCREW,2-56X3/16,RND HD	WECKESSER	N-256-3/16 ROUND HEAD	
22	1	297-98-00145		STDF,RND, .312L,.187DIA	AMATOM	8078-PH-0256	
23	AR	276-02-00037		WIRE,#22,SOL, WHT, 600V	PRCMT OPTION	MIL-W-16878/4*SIL CTD*	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	304-01-01209	600	CAP. 12PF .5PF 500V	EMR	304-01-01209	
C 3	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 4	1	304-08-04709	600	CAP. 47PF .5PF 500V	EMR	304-08-04709	
C 5	AR	999-01-00009	15862	CAP., *FREQ/VAR*			
C 6	1	300-00-00000	600	CAP., *T/VAR*			
C 7	AR	999-01-00002	15862	CAP., *FREQ/VAR*			
C 8	1	304-08-03009	600	CAP. 30PF .5PF 500V	EMR	304-08-03009	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	AR	999-01-00010	15862	CAP., *FREQ/VAR*			
C 11	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 12	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 13	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 15	1	304-13-05109	600	CAP. 51PF 1% 500V	EMR	304-13-05109	
C 16	AR	999-01-00009	15862	CAP., *FREQ/VAR*			
C 17	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 18	1	337-12-22004	601	CAP., 22MF 10% 15V	EMR	337-12-22004	
C 19	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 20	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 21	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 22	AR	999-01-00012	15862	CAP., *FREQ/VAR*			
C 23	1	999-01-00012	15862	CAP., *FREQ/VAR*			

FIRST USAGE MODEL 4151-01

Table 6-7 (Cont'd.).

205-89-00379 15813 SHT 2 OF 4

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
C 24	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 25	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 26	AR	999-01-00013	15862	CAP., *FREQ/VAR*			
C 27	AR	999-01-00014	15862	CAP., *FREQ/VAR*			
C 28	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 29	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 30	AR	999-01-00013	15862	CAP., *FREQ/VAR*			
C 31 THRU C 37	7	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 38	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 39	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 40 THRU C 42	3	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 43	1	304-62-10000	600	CAP. 1000PF 1% 100V	EMR	304-62-10000	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-99-00119	642-13	DIODE,ZENER 0.4W 12.0V	EMR	088-99-00119	
CR 3	1	088-99-00379	642-11	DIODE,ZENER 0.4W 9.1V	EMR	088-99-00379	
CR 4	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 5	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 6	1	088-99-00209	642-10	DIODE,ZENER 0.4W 8.2V	EMR	088-99-00209	
CR 7	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 8	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 10	1	088-99-00329	642-07	DIODE,ZENER 0.4W 6.2V	EMR	088-99-00329	
CR 11	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 12	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 13	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 14	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 15	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 16	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 17	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 18	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 19	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
L 1 THRU L 8	8	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2 THRU Q 5	4	263-97-49170		XSTR,PNP SWITCH/AMPL 30V	MML 4	2N4917	
Q 6	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 7	1	263-10-35650		XSTR,NPN 40MHZ,30V AMPL	JEDEC	2N3565	
Q 8 THRU Q 11	4	263-99-00099	801	XSTR,NPN,SW,HS	EMR	263-99-00099	* Q
Q 12	1	263-10-36460		XSTR,NPN 40V,300MA SW,ON	JEDEC	2N3646	
Q 13	1	263-10-41210		XSTR,PNP 40V SW-RF AMPL	JEDEC	2N4121	* Q
Q 14	1	263-10-41210		XSTR,PNP 40V SW-RF AMPL	JEDEC	2N4121	

FIRST USAGE MODEL 4151-01

Table 6-7 (Cont'd.).

205-89-00379 15813 SHT 3 OF 4

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAC
Q 15 THRU Q 18	4	263-10-36460		XSTR,NPN 40V,300MA SW,ON	JEDEC	2N3646	
Q 19	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 20	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
R 1	1	616-02-27002		RES,270K 5% 1/4W	ALLEN BRAD	RC07GF274J	
R 2	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	616-02-33009		RES,330 OHM 5% 1/4W	ALLEN BRAD	RC07GF331J	
R 5	1	608-09-80600	624	RES, 8.06K 1% 1/10W	EMR	608-09-80600	*
R 6	1	608-09-15000	624	RES, 1.50K 1% 1/10W	EMR	608-09-15000	*
R 7	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30100	*
R 8	1	608-09-90900	624	RES. 9.09K 1% 1/10W	EMR	608-09-90900	*
R 9	1	608-09-00000	624	RES. *TEST/VAR*			
R 10	1	616-02-56000		RES,5.6K 5% 1/4W	ALLEN BRAD	RC07GF562J	
R 11	1	616-02-01509		RES,15 OHM 5% 1/4W	ALLEN BRAD	RC07GF150J	
R 12	AR	999-01-00017	15862	RES, *FREQ/VAR*			
R 13	AR	999-01-00003	15862	RES, *FREQ/VAR*			
R 14	AR	999-01-00018	15862	RES, *FREQ/VAR*			
R 15	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	*
R 16	1	201-98-00093		POT,TRMR, 5.0 K 10% .5W	BECK/MML27	62PR5K	*
R 17	1	616-02-10001		RES,10K 5% 1/4W	ALLEN BRAD	RC07GF103J	
R 18	AR	999-01-00004	15862	RES, *FREQ/VAR*			
R 19	1	616-02-22000		RES,2.2K 5% 1/4W	ALLEN BRAD	RC07GF222J	
R 20	1	608-09-00000	624	RES, *T/VAR*			
R 21	1	608-09-00000	624	RES, *T/VAR*			
R 22	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 23	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 24	1	616-02-05109		RES,51 OHM 5% 1/4W	ALLEN BRAD	RC07GF510J	
R 25	1	616-02-05109		RES,51 OHM 5% 1/4W	ALLEN BRAD	RC07GF510J	
R 26	1	616-02-68009		RES,680 OHM 5% 1/4W	ALLEN BRAD	RC07GF681J	
R 27	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30100	*
R 28	1	608-09-75000	624	RES, 7.50K 1% 1/10W	EMR	608-09-75000	*
R 29 THRU R 31	3	608-09-75009	624	RES, 750.0 OHM 1% 1/10W	EMR	608-09-75009	*
R 32	1	608-09-56200	624	RES, 5.62K 1% 1/10W	EMR	608-09-56200	*
R 33	1	608-09-00000	624	RES, *T/VAR* 1% 1/10W			
R 34	1	616-02-27002		RES,270K 5% 1/4W	ALLEN BRAD	RC07GF274J	
R 35	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 36	1	608-09-57609	624	RES, 576.0 OHM 1% 1/10W	EMR	608-09-57609	*
R 37	1	608-09-57609	624	RES, 576.0 OHM 1% 1/10W	EMR	608-09-57609	
R 38	AR	999-01-00006	15862	RES, *FREQ/VAR*			
R 39	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	*
R 40	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	
R 41	AR	999-01-00006	15862	RES, *FREQ/VAR*			
R 42	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	*
R 43	1	616-02-22000		RES,2.2K 5% 1/4W	ALLEN BRAD	RC07GF222J	
R 44	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	

FIRST USAGE MODEL 4151-01

Table 6-7 (Cont'd.).

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	US
R 45	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 46	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 47	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 48	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	
R 49	1	608-09-63400	624	RES, 6.34K 1% 1/10W	EMR	608-09-63400	
R 50	1	608-09-93100	624	RES, 9.31K 1% 1/10W	EMR	608-09-93100	
R 51	1	608-09-21509	624	RES, 215.0 OHM 1% 1/10W	EMR	608-09-21509	
R 52	1	622-02-00000		RES,*T/VAR*36-180 OHM 5%			
R 53	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 54	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 55	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 56	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 57	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 58	AR	999-01-00007	15862	RES, *FREQ/VAR*			
R 59	1	616-02-62000		RES,6.2K 5% 1/4W	ALLEN BRAD	RC07GF622J	
R 60	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 61	AR	999-01-00008	15862	RES, *FREQ/VAR*			
R 62	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 63	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 64	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 65	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 66	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 68	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	
R 69	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	
R 70	1	608-09-00000	624	RES, *T/VAR*			
R 71	1	608-09-00000	624	RES, *T/VAR*			
R 72	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
Z 1	1	046-89-00009	12181	IC,ASSY,FOLLOWER,NPN	EMR	046-89-00009	
Z 2	1	046-97-00138		IC,LIN COMPTR,DIFF HS	TI/MML40	SN72710L	
Z 3	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
REF 1	1	905-01-00320	15811	SCHEMATIC,PWA	EMR	905-01-00320	
REF 2	1	905-04-00002	9500-1	SPEC,COMPONENT SPACING	EMR	905-04-00002	
REF 3	1	905-05-00122	15862	VARIABLE CHART,MOD4151-01	EMR	905-05-00122	
REF 4	1	905-14-00061	15699	WIRE SCHEDULE	EMR	905-14-00061	
REF 5	1	905-05-00166	14519	VARIABLE CHART,MODEL 4151	EMR	905-05-00166	
REF 6	1	905-07-00163	15711	SPEC,ENG,MODEL 4151	EMR	905-07-00163	

FIRST USAGE MODEL 4151-01

Table 6-8.

EMR - TELEMETRY

PARTS LIST 15813-1 REV DATE 09/02/76 REV LTR R

LIST TITLE PWA,CHANNEL SELECTOR CHGE CONT NO. CODE IDENT SHT 1 OF 4
PART NO. 205-89-00380 ECO 53810 06141 CKD BY.

ITEM NO.		QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAG
	1	1	204-89-00165	15812	PWB,CHANNEL SELECTOR	EMR	204-89-00165	
	2	1	232-99-00001	5337	SHIELD	EMR	232-99-00001	
	3	1	140-99-00006	5211	INS	EMR	140-99-00006	
	4	2	298-98-00007		HTSK,FAN TOP	IERC	TXC-20B OR TXC-20U	
	5	17	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
	6	2	189-98-00011		PAD,XSTR,TO-5 8PIN,.075H	MILTON ROSS	10193-DAP	
	7	20	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
	8	AR	229-02-00066		SCREW,2-56X5/16 PAN HD	PRCMT OPTION	MS51957-4	*
	9	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
	10	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
	11	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
	12	AR	999-01-00015	15863	FIL, *FREQ/VAR*			
	13	AR	999-01-00016	15863	SHIELD, *FREQ/VAR*			
	14	1	232-99-00018	15724	SHIELD,FILTER CARD	EMR	232-99-00018	
	15	3	273-98-00038		WASHER,FIBRE,.10 IDX.190	SEASTROM	5602-55-32	
	16	AR	252-98-00019		TAPE,GLASS CLOTH,3/8 WIDE	3M	27/BY DESCRIPTION	
	17	1	999-05-00002	14519	PWA,*POA VAR*			
	18	1	999-05-00003	14519	INSUL,*POA VAR*			
	19	AR	999-05-00004	14519	WASHER,*POA VAR*			
	20	AR	999-05-00005	14519	SCREW,*POA VAR*			
	21	2	229-98-00098		SCREW,2-56X3/16,RND HD	WECKESSER	N-256-3/16 ROUND HEAD	
	22	1	297-98-00145		STDF,RND, .312L,.187DIA	AMATOM	8078-PH-0256	
	23	AR	276-02-00037		WIRE,#22,SOL, WHT, 600V	PRCMT OPTION	MIL-W-16878/4*SIL CTD*	
C	1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C	2	1	304-01-01209	600	CAP. 12PF .5PF 500V	EMR	304-01-01209	
C	3	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C	4	1	304-08-04709	600	CAP. 47PF .5PF 500V	EMR	304-08-04709	
C	5	AR	999-01-00009	15863	CAP., *FREQ/VAR*			
C	6	1	300-00-00000	600	CAP., *T/VAR*			
C	7	AR	999-01-00002	15863	CAP., *FREQ/VAR*			
C	8	1	304-08-03009	600	CAP. 30PF .5PF 500V	EMR	304-08-03009	
C	9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C	10	AR	999-01-00010	15863	CAP., *FREQ/VAR*			
C	11	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C	12	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C	13	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C	15	1	304-13-05109	600	CAP. 51PF 1% 500V	EMR	304-13-05109	
C	16	AR	999-01-00009	15863	CAP., *FREQ/VAR*			
C	17	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C	18	1	337-12-22004	601	CAP., 22MF 10% 15V	EMR	337-12-22004	
C	19	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C	20	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C	21	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C	22	AR	999-01-00012	15863	CAP., *FREQ/VAR*			
C	23	1	999-01-00012	15863	CAP., *FREQ/VAR*			

FIRST USAGE MODEL 4151-02

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
C 24	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 25	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 26	AR	999-01-00013	15863	CAP., *FREQ/VAR*			
C 27	AR	999-01-00014	15863	CAP., *FREQ/VAR*			
C 28	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 29	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 30	AR	999-01-00013	15863	CAP., *FREQ/VAR*			
C 31 THRU C 37	7	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 38	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 39	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 40 THRU C 42	3	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 43	1	304-62-10000	600	CAP. 1000PF 1% 100V	EMR	304-62-10000	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-99-00119	642-13	DIODE,ZENER 0.4W 12.0V	EMR	088-99-00119	
CR 3	1	088-99-00379	642-11	DIODE,ZENER 0.4W 9.1V	EMR	088-99-00379	
CR 4	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 5	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 6	1	088-99-00209	642-10	DIODE,ZENER 0.4W 8.2V	EMR	088-99-00209	
CR 7	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 8	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 10	1	088-99-00329	642-07	DIODE,ZENER 0.4W 6.2V	EMR	088-99-00329	
CR 11	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 12	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 13	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 14	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 15	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 16	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 17	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 18	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 19	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
L 1 THRU L 8	8	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2 THRU Q 5	4	263-97-49170		XSTR,PNP SWITCH/AMPL 30V	MML 4	2N4917	
Q 6	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 7	1	263-10-35650		XSTR,NPN 40MHZ,30V AMPL	JEDEC	2N3565	
Q 8 THRU Q 11	4	263-99-00099	801	XSTR,NPN,SW,HS	EMR	263-99-00099	*
Q 12	1	263-10-36460		XSTR,NPN 40V,300MA SW,ON	JEDEC	2N3646	
Q 13	1	263-10-41210		XSTR,PNP 40V SW-RF AMPL	JEDEC	2N4121	*
Q 14	1	263-10-41210		XSTR,PNP 40V SW-RF AMPL	JEDEC	2N4121	

FIRST USAGE MODEL 4151-02

Table 6-8 (Cont'd.).

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
Q 15 THRU Q 18	4	263-10-36460		XSTR,NPN 40V,300MA SW,ON	JEDEC	2N3646	
Q 19	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 20	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
R 1	1	616-02-27002		RES,270K 5% 1/4W	ALLEN BRAD	RC07GF274J	
R 2	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	616-02-33009		RES,330 OHM 5% 1/4W	ALLEN BRAD	RC07GF331J	
R 5	1	608-09-80600	624	RES, 8.06K 1% 1/10W	EMR	608-09-80600	* P
R 6	1	608-09-15000	624	RES, 1.50K 1% 1/10W	EMR	608-09-15000	* P
R 7	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30100	* P
R 8	1	608-09-90900	624	RES. 9.09K 1% 1/10W	EMR	608-09-90900	* P
R 9	1	608-09-00000	624	RES. *TEST/VAR*			
R 10	1	616-02-56000		RES,5.6K 5% 1/4W	ALLEN BRAD	RC07GF562J	
R 11	1	616-02-01509		RES,15 OHM 5% 1/4W	ALLEN BRAD	RC07GF150J	
R 12	AR	999-01-00017	15863	RES, *FREQ/VAR*			
R 13	AR	999-01-00003	15863	RES, *FREQ/VAR*			
R 14	AR	999-01-00018	15863	RES, *FREQ/VAR*			
R 15	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	* P
R 16	1	291-98-00093		POT,TRMR, 5.0 K 10% .5W	BECK/MML27	62PR5K	* K
R 17	1	616-02-10001		RES,10K 5% 1/4W	ALLEN BRAD	RC07GF103J	
R 18	AR	999-01-00004	15863	RES, *FREQ/VAR*			
R 19	1	616-02-22000		RES,2.2K 5% 1/4W	ALLEN BRAD	RC07GF222J	
R 20	1	608-09-00000	624	RES, *T/VAR*			
R 21	1	608-09-00000	624	RES, *T/VAR*			
R 22	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 23	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 24	1	616-02-05109		RES,51 OHM 5% 1/4W	ALLEN BRAD	RC07GF510J	
R 25	1	616-02-05109		RES,51 OHM 5% 1/4W	ALLEN BRAD	RC07GF510J	
R 26	1	616-02-68009		RES,680 OHM 5% 1/4W	ALLEN BRAD	RC07GF681J	
R 27	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30100	* P
R 28	1	608-09-75000	624	RES, 7.50K 1% 1/10W	EMR	608-09-75000	* P
R 29 THRU R 31	3	608-09-75009	624	RES, 750.0 OHM 1% 1/10W	EMR	608-09-75009	* P
R 32	1	608-09-56200	624	RES, 5.62K 1% 1/10W	EMR	608-09-56200	* P
R 33	1	608-09-00000	624	RES, *T/VAR* 1% 1/10W			
R 34	1	616-02-27002		RES,270K 5% 1/4W	ALLEN BRAD	RC07GF274J	
R 35	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 36	1	608-09-57609	624	RES, 576.0 OHM 1% 1/10W	EMR	608-09-57609	* P
R 37	1	608-09-57609	624	RES, 576.0 OHM 1% 1/10W	EMR	608-09-57609	
R 38	AR	999-01-00006	15863	RES, *FREQ/VAR*			
R 39	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	* P
R 40	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	
R 41	AR	999-01-00006	15863	RES, *FREQ/VAR*			
R 42	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	* P
R 43	1	616-02-22000		RES,2.2K 5% 1/4W	ALLEN BRAD	RC07GF222J	
R 44	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	

FIRST USAGE MODEL 4151-02

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 45	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 46	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 47	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 48	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	* P
R 49	1	608-09-63400	624	RES, 6.34K 1% 1/10W	EMR	608-09-63400	* P
R 50	1	608-09-93100	624	RES, 9.31K 1% 1/10W	EMR	608-09-93100	* P
R 51	1	608-09-21509	624	RES, 215.0 OHM 1% 1/10W	EMR	608-09-21509	* P
R 52	1	622-02-00000		RES,*T/VAR*36-180 OHM 5%			
R 53	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 54	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 55	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 56	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 57	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 58	AR	999-01-00007	15863	RES, *FREQ/VAR*			
R 59	1	616-02-62000		RES,6.2K 5% 1/4W	ALLEN BRAD	RC07GF622J	
R 60	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 61	AR	999-01-00008	15863	RES, *FREQ/VAR*			
R 62	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 63	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 64	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 65	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 66	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 68	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	* P
R 69	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	
R 70	1	608-09-00000	624	RES, *T/VAR*			
R 71	1	608-09-00000	624	RES, *T/VAR*			
R 72	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
Z 1	1	046-89-00009	12181	IC,ASSY,FOLLOWER,NPN	EMR	046-89-00009	* Q
Z 2	1	046-97-00138		IC,LIN COMPTR,DIFF HS	TI/MML40	SN72710L	
Z 3	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
REF 1	1	905-01-00320	15811	SCHEMATIC,PWA	EMR	905-01-00320	
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 3	1	905-05-00123	15863	VARIABLE CHART,MOD4151-02	EMR	905-05-00123	
REF 4	1	905-14-00061	15699	WIRE SCHEDULE	EMR	905-14-00061	
REF 5	1	905-05-00166	14519	VARIABLE CHART,MODEL 4151	EMR	905-05-00166	
REF 6	1	905-07-00163	15711	SPEC,ENG,MODEL 4151	EMR	905-07-00163	

FIRST USAGE MODEL 4151-02

Table 6-9. EMR - TELEMETRY

PARTS LIST 15813-2 REV DATE 09/02/76 REV LTR M

LIST TITLE PWA,CHANNEL SELECTOR CHGE CONT NO. CODE IDENT SHT 1 OF 1
PART NO. 205-89-00381 ECO 53810 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USA
1	1	204-89-00165	15812	PWB,CHANNEL SELECTOR	EMR	204-89-00165	
2	1	232-99-00001	5337	SHIELD	EMR	232-99-00001	
3	1	140-99-00006	5211	INS	EMR	140-99-00006	
4	2	298-98-00007		HTSK,FAN TOP	IERC	TXC-20B OR TXC-20U	
5	17	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
6	2	189-98-00011		PAD,XSTR,TO-5 8PIN,.075H	MILTON ROSS	10193-DAP	
7	20	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
8	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	
9	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
10	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
11	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
17	1	999-05-00002	14519	PWA,*POA VAR*			
18	1	999-05-00003	14519	INSUL,*POA VAR*			
19	AR	999-05-00004	14519	WASHER,*POA VAR*			
20	AR	999-05-00005	14519	SCREW,*POA VAR*			
21	2	229-98-00098		SCREW,2-56X3/16,RND HD	WECKESSER	N-256-3/16 ROUND HEAD	
22	1	297-98-00145		STOF,RND, .312L,.187DIA	AMATOM	8078-PH-0256	
23	AR	276-02-00037		WIRE,#22,SOL, WHT, 600V	PRCMT OPTION	MIL-W-16878/4*STL CTD*	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	304-01-01209	600	CAP. 12PF .5PF 500V	EMR	304-01-01209	
C 3	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 4	1	304-08-04709	600	CAP. 47PF .5PF 500V	EMR	304-08-04709	
C 5	AR	999-01-00001	15864	CAP., *FREQ/VAR*			
C 6	1	300-00-00000	600	CAP., *T/VAR*			
C 7	AR	999-01-00002	15864	CAP., *FREQ/VAR*			
C 8	1	304-08-03009	600	CAP. 30PF .5PF 500V	EMR	304-08-03009	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	AR	999-01-00003	15864	CAP., *FREQ/VAR*			
C 11	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 12	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 13	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 15	1	304-13-05109	600	CAP. 51PF 1% 500V	EMR	304-13-05109	
C 16	AR	999-01-00001	15864	CAP., *FREQ/VAR*			
C 17	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 18	1	337-12-22004	601	CAP., 22MF 10% 15V	EMR	337-12-22004	
C 19	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 20	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 21	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 22	AR	999-01-00004	15864	CAP., *FREQ/VAR*			
C 23	1	999-01-00004	15864	CAP., *FREQ/VAR*			
C 24	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 25	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 26	AR	999-01-00005	15864	CAP., *FREQ/VAR*			
C 27	AR	999-01-00006	15864	CAP., *FREQ/VAR*			
C 28	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	

FIRST USAGE MODEL 4151-03

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
C 29	1	304-01-01009	600	CAP. 10PF .5PF 500V	EMR	304-01-01009	
C 30	AR	999-01-00005	15864	CAP., *FREQ/VAR*			
C 31	7	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
THRU							
C 37							
C 38	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 39	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 40	3	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
THRU							
C 42							
C 43	1	304-62-10000	600	CAP. 1000PF 1% 100V	EMR	304-62-10000	
C 44	1	301-13-68002		CAP., .68MF 20% 50V LS.20	MML 48	8131-050-651-684M/MML	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-99-00119	642-13	DIODE,ZENER 0.4W 12.0V	EMR	088-99-00119	
CR 3	1	088-99-00379	642-11	DIODE,ZENER 0.4W 9.1V	EMR	088-99-00379	
CR 4	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 5	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 6	1	088-99-00209	642-10	DIODE,ZENER 0.4W 8.2V	EMR	088-99-00209	
CR 7	1	088-10-48300		DIODE,STABISTOR 30V/100UA	JEDEC	1N4830	
CR 8	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 10	1	088-99-00329	642-07	DIODE,ZENER 0.4W 6.2V	EMR	088-99-00329	
CR 11	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 12	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 13	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 14	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 15	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 16	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 17	1	088-97-08230		DIODE,REF. 6.2V@7.5MA	MML 2	1N823	
CR 18	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %	MML 2	1N936/1N936A/1N936B	
CR 19	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
L 1	8	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
THRU							
L 8							
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	4	263-97-49170		XSTR,PNP SWITCH/AMPL 30V	MML 4	2N4917	
THRU							
Q 5							
Q 6	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 7	1	263-10-35650		XSTR,NPN 40MHZ,30V AMPL	JEDEC	2N3565	
Q 8	4	263-99-00099	801	XSTR,NPN,SW,HS	EMR	263-99-00099	*
THRU							
Q 11							
Q 12	1	263-10-36460		XSTR,NPN 40V,300MA SW,ON	JEDEC	2N3646	
Q 13	1	263-10-41210		XSTR,PNP 40V SW-RF AMPL	JEDEC	2N4121	*
Q 14	1	263-10-41210		XSTR,PNP 40V SW-RF AMPL	JEDEC	2N4121	
Q 15	4	263-10-36460		XSTR,NPN 40V,300MA SW,ON	JEDEC	2N3646	
THRU							
Q 18							
Q 19	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	

FIRST USAGE MODEL 4151-03

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
Q 20	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
R 1	1	616-02-27002		RES,270K 5% 1/4W	ALLEN BRAD	RC07GF274J	
R 2	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	616-02-33009		RES,330 OHM 5% 1/4W	ALLEN BRAD	RC07GF331J	
R 5	1	608-09-80600	624	RES, 8.06K 1% 1/10W	EMR	608-09-80600	* P
R 6	1	608-09-15000	624	RES, 1.50K 1% 1/10W	EMR	608-09-15000	* P
R 7	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30100	* P
R 8	1	608-09-90900	624	RES. 9.09K 1% 1/10W	EMR	608-09-90900	* P
R 9	1	608-09-00000	624	RES. *TEST/VAR*			
R 10	1	616-02-56000		RES,5.6K 5% 1/4W	ALLEN BRAD	RC07GF562J	
R 11	1	616-02-01509		RES,15 OHM 5% 1/4W	ALLEN BRAD	RC07GF150J	
R 12	AR	999-01-00007	15864	RES, *FREQ/VAR*			
R 13	AR	999-01-00008	15864	RES, *FREQ/VAR*			
R 14	AR	999-01-00009	15864	RES, *FREQ/VAR*			
R 15	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	* P
R 16	1	201-98-00093		POT,TRMR, 5.0 K 10% .5W	BECK/MML27	62PR5K	* K
R 17	1	616-02-10091		RES,10K 5% 1/4W	ALLEN BRAD	RC07GF103J	
R 18	AR	999-01-00010	15864	RES, *FREQ/VAR*			
R 19	1	616-02-22000		RES,2.2K 5% 1/4W	ALLEN BRAD	RC07GF222J	
R 20	1	608-09-00000	624	RES, *T/VAR*			
R 21	1	608-09-00000	624	RES, *T/VAR*			
R 22	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 23	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 24	1	616-02-05109		RES,51 OHM 5% 1/4W	ALLEN BRAD	RC07GF510J	
R 25	1	616-02-05109		RES,51 OHM 5% 1/4W	ALLEN BRAD	RC07GF510J	
R 26	1	616-02-68009		RES,680 OHM 5% 1/4W	ALLEN BRAD	RC07GF681J	
R 27	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30100	* P
R 28	1	608-09-75000	624	RES, 7.50K 1% 1/10W	EMR	608-09-75000	* P
R 29 THRU R 31	3	608-09-75009	624	RES, 750.0 OHM 1% 1/10W	EMR	608-09-75009	* P
R 32	1	608-09-56200	624	RES, 5.62K 1% 1/10W	EMR	608-09-56200	* P
R 33	1	608-09-00000	624	RES, *T/VAR* 1% 1/10W			
R 34	1	616-02-27002		RES,270K 5% 1/4W	ALLEN BRAD	RC07GF274J	
R 35	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 36	1	608-09-57609	624	RES, 576.0 OHM 1% 1/10W	EMR	608-09-57609	* P
R 37	1	608-09-57609	624	RES, 576.0 OHM 1% 1/10W	EMR	608-09-57609	
R 38	AR	999-01-00011	15864	RES, *FREQ/VAR*			
R 39	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	* P
R 40	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	
R 41	AR	999-01-00011	15864	RES, *FREQ/VAR*			
R 42	1	608-09-23700	624	RES., 2.37K 1% 1/10W	EMR	608-09-23700	* P
R 43	1	616-02-22000		RES,2.2K 5% 1/4W	ALLEN BRAD	RC07GF222J	
R 44	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 45	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 46	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 47	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 48	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	* P

FIRST USAGE MODEL 4151-03

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 49	1	608-09-63400	624	RES, 6.34K 1% 1/10W	EMR	608-09-63400	* P
R 50	1	608-09-93100	624	RES, 9.31K 1% 1/10W	EMR	608-09-93100	* P
R 51	1	608-09-21509	624	RES, 215.0 OHM 1% 1/10W	EMR	608-09-21509	* P
R 52	1	622-02-00000		RES,*T/VAR*36-180 OHM 5%			
R 53	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 54	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 55	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 56	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 57	1	616-02-12001		RES,12K 5% 1/4W	ALLEN BRAD	RC07GF123J	
R 58	AR	999-01-00012	15864	RES, *FREQ/VAR*			
R 59	1	616-02-62000		RES,6.2K 5% 1/4W	ALLEN BRAD	RC07GF622J	
R 60	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 61	AR	999-01-00013	15864	RES, *FREQ/VAR*			
R 62	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 63	1	616-02-68000		RES,6.8K 5% 1/4W	ALLEN BRAD	RC07GF682J	
R 64	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 65	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 66	1	616-02-20000		RES,2K 5% 1/4W	ALLEN BRAD	RC07GF202J	
R 68	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	* P
R 69	1	608-09-13000	624	RES 1.30K 1% 1/10W	EMR	608-09-13000	
R 70	1	608-09-00000	624	RES, *T/VAR*			
R 71	1	608-09-00000	624	RES, *T/VAR*			
R 72	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 73	1	616-02-10001		RES,10K 5% 1/4W	ALLEN BRAD	RC07GF103J	
Z 1	1	046-89-00009	12181	IC,ASSY,FOLLOWER,NPN	EMR	046-89-00009	* G
Z 2	1	046-97-00138		IC,LIN COMPTR,DIFF HS	TI/MML40	SN72710L	
Z 3	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
REF 1	1	905-01-00320	15811	SCHEMATIC,PWA	EMR	905-01-00320	
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 3	1	905-05-00124	15864	VARIABLE CHART,MOD4151-03	EMR	905-05-00124	
REF 4	1	905-14-00061	15699	WIRE SCHEDULE	EMR	905-14-00061	
REF 5	1	905-05-00166	14519	VARIABLE CHART,MODEL 4151	EMR	905-05-00166	
REF 6	1	905-07-00163	15711	SPEC,ENG,MODEL 4151	EMR	905-07-00163	

FIRST USAGE MODEL 4151-03

Table 6-10. EMR - TELEMETRY

PARTS LIST 15819 REV DATE 01/20/77 REV LTR T

LIST TITLE PWA,5POLE LPOF CHGE CONT NO. CODE IDENT SHT 1 OF 3
PART NO. 205-89-00382 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	204-89-00166	15818	PWB,LPOF,5 POLE	EMR	204-89-00166	
2	13	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	2	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	* P
5	2	287-02-00002		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	* P
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	1	049-98-00010		CLIP,THERMAL EQUALIZING	WAKEFIELD	259-18-25	
10	9	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
12	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
13	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
15	AR	268-98-00001		TUBING,1/4,THERMO-FIT,WHT	RAYCHEM	RNF-100	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 3	AR	999-01-00011	15815	CAP., *FREQ/VAR*			
C 4	AR	999-01-00012	15815	CAP., *FREQ/VAR*			
C 5	1	301-03-22000		CAP.,2200PF 20% 50V	MML 48	8111-050-651-222M/MML	* Q
C 6	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 7	AR	999-01-00013	15815	CAP., *FREQ/VAR*			
C 8	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	AR	999-01-00014	15815	CAP., *FREQ/VAR*			
C 11	1	300-00-00000	600	CAP., *TEST/VAR*			
C 12	1	304-00-00000	600	CAP.,*TVAR*			
C 13 THRU C 15	1	999-01-00016	15815	CAP., *FREQ/VAR*			
C 16	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 17	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 18	1	304-08-02009	600	CAP.,20PF .5PF 500V	EMR	304-08-02009	
C 19	1	336-10-68003	601	CAP., 6.8MF 10% 6V	EMR	336-10-68003	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 3	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 4	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 5	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 6	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 7	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 8	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 9	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
FL 1	AR	999-01-00017	15815	FIL, *FREQ/VAR*			
L 1 THRU L 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	

FIRST USAGE MODEL 4157-02

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
Q 6	1	263-35-00039		XSTR,NPN,MAT.PR,VBE1-VBE2	AMPEREX	A642/S	
Q 7	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 8	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 9	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 10	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 11	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 12	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	608-09-61900	624	RES. 6.19K 1% 1/10W	EMR	608-09-61900	* 1
R 2	1	999-01-00018	15815	RES,*FVAR*			
R 3	1	616-02-10003		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 5	1	616-02-11009		RES,110 OHM 5% 1/4W	ALLEN BRAD	RC07GF111J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 8	AR	999-01-00001	15815	RES, *FREQ/VAR*			
R 9	AR	999-01-00002	15815	RES, *FREQ/VAR*			
R 10	AR	999-01-00003	15815	RES, *FREQ/VAR*			
R 11	AR	999-01-00004	15815	RES, *FREQ/VAR*			
R 12	AR	999-01-00005	15815	RES, *FREQ/VAR*			
R 13	AR	999-01-00006	15815	RES, *FREQ/VAR*			
R 14	AR	999-01-00007	15815	RES, *FREQ/VAR*			
R 15	AR	999-01-00008	15815	RES, *FREQ/VAR*			
R 16	AR	999-01-00009	15815	RES, *FREQ/VAR*			
R 17	AR	999-01-00010	15815	RES, *FREQ/VAR*			
R 18	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801	* 1
R 19	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100	* 1
R 20	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 21	1	616-02-30009		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J	
R 22	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 23	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 24	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 25	1	608-09-18201	624	RES, 18.2K 1% 1/10W	EMR	608-09-18201	* 1
R 26	1	608-09-15800	624	RES. 1.58K 1% 1/10W	EMR	608-09-15800	* 1
R 27	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 28	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 29	1	616-02-91000		RES,9.1K 5% 1/4W	ALLEN BRAD	RC07GF912J	
R 30	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	*
R 31	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	*
R 32	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 33	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	*
R 34	1	999-01-00015	15815	RES,*FVAR*			
R 35	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 36	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 37	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	

FIRST USAGE MODEL 4157-02

Table 6-10.

205-89-00382 15819 SHT 3 OF 3

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 38	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 39	1	201-98-00268		POT,TRMR, 20 K 10% .5W	BECK/MML27	72PMR20K	* P
R 40	1	999-01-00019	15815	RES,*FVAR*			
R 41	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
U 1	1	999-01-00020	15815	IC,*FVAR*			
REF 1	1	905-01-00321	15817	SCHEMATIC,PWA	EMR	905-01-00321	
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 3	1	905-05-00121	15815	VARIABLE CHART,MOD4157-02	EMR	905-05-00121	
REF 4	1	905-05-00167	14520	VARIABLE CHART,MODEL 4157	EMR	905-05-00167	
REF 5	1	905-07-00164	15712	SPEC,ENG,MODEL 4157 L.P.	EMR	905-07-00164	

FIRST USAGE MODEL 4157-02

Table 6-11.

EMR - TELEMETRY

PARTS LIST 15819-1 REV DATE 01/20/77 REV LTR U

LIST TITLE PWA,5 POLE LPOF CHGE CONT NO. CODE IDENT SHT 1 OF 2
PART NO. 205-89-00390 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	204-89-00166	15818	PWB,LPOF,5 POLE	EMR	204-89-00166	
2	13	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	2	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	*
5	2	287-02-00002		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	*
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	1	049-98-00010		CLIP,THERMAL EQUALIZING	WAKEFIELD	259-10-25	
10	2	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
12	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
13	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
15	AR	268-98-00001		TUBING,1/4,THERMO-FIT,WHT	RAYCHEM	RNF-100	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 3	AR	999-01-00011	15865	CAP., *FREQ/VAR*			
C 4	AR	999-01-00012	15865	CAP., *FREQ/VAR*			
C 5	1	301-03-22000		CAP.,2200PF 20% 50V	MML 48	8111-050-651-222M/MML	*
C 6	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 7	AR	999-01-00013	15865	CAP., *FREQ/VAR*			
C 8	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	AR	999-01-00014	15865	CAP., *FREQ/VAR*			
C 11	1	300-00-00000	600	CAP., *TEST/VAR*			
C 12	1	304-00-00000	600	CAP,*TVAR*			
C 13 THRU C 15	1	999-01-00015	15865	CAP., *FREQ/VAR*			
C 16	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 17	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 18	1	304-08-02009	600	CAP.,20PF .5PF 500V	EMR	304-08-02009	
C 19	1	336-10-68003	601	CAP., 6.8MF 10% 6V	EMR	336-10-68003	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 3	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 4	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 5	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 6	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 7	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 8	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 9	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
FL 1	AR	999-01-00017	15865	FIL, *FREQ/VAR*			
L 1 THRU L 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	

FIRST USAGE MODEL 4157-03

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
Q 6	1	263-35-00039		XSTR,NPN,MAT.PR,VBE1-VBE2	AMPEREX	A642/S	
Q 7	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 8	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 9	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 10	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 11	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 12	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	608-09-61900	624	RES. 6.19K 1% 1/10W	EMR	608-09-61900	* P
R 2	1	999-01-00018	15865	RES,*FVAR*			
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 5	1	616-02-11009		RES,110 OHM 5% 1/4W	ALLEN BRAD	RC07GF111J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 8	AR	999-01-00001	15865	RES, *FREQ/VAR*			
R 9	AR	999-01-00002	15865	RES, *FREQ/VAR*			
R 10	AR	999-01-00003	15865	RES, *FREQ/VAR*			
R 11	AR	999-01-00004	15865	RES, *FREQ/VAR*			
R 12	AR	999-01-00005	15865	RES, *FREQ/VAR*			
R 13	AR	999-01-00006	15865	RES, *FREQ/VAR*			
R 14	1	999-01-00006	15865	RES, *FREQ/VAR*			
R 15	AR	999-01-00008	15865	RES, *FREQ/VAR*			
R 16	AR	999-01-00009	15865	RES, *FREQ/VAR*			
R 17	AR	999-01-00010	15865	RES, *FREQ/VAR*			
R 18	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801	* P
R 19	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100	* P
R 20	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 21	1	616-02-30009		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J	
R 22	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 23	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 24	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 25	1	608-09-18201	624	RES, 18.2K 1% 1/10W	EMR	608-09-18201	* P
R 26	1	608-09-15800	624	RES. 1.58K 1% 1/10W	EMR	608-09-15800	* P
R 27	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 28	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 29	1	616-02-91030		RES,9.1K 5% 1/4W	ALLEN BRAD	RC07GF912J	
R 30	1	608-09-12409	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 31	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	* P
R 32	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 33	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 34	1	999-01-00015	15865	RES,*FVAR*			
R 35	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 36	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 37	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	

FIRST USAGE MODEL 4157-03

Table 6-11 (Cont'd.).

205-69-00390 15819-1 SHT 3 OF 3

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 38	1	616-02-10000		RES,1.0K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 39	1	201-98-00268		POT,TRMR, 20 K 10% .5W	BECK/MML27	72PMR20K	* P
R 40	1	999-01-00019	15865	RES,*FVAR*			
R 41	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
U 1	1	999-01-00020	15865	IC,*FVAR*			
REF 1	1	905-01-00321	15817	SCHEMATIC,PWA	EMR	905-01-00321	
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 3	1	905-05-00125	15865	VARIABLE CHART,MOD4157-03	EMR	905-05-00125	
REF 4	1	905-05-00167	14520	VARIABLE CHART,MODEL 4157	EMR	905-05-00167	
REF 5	1	905-07-00164	15712	SPEC,ENG,MODEL 4157 L.P.	EMR	905-07-00164	

FIRST USAGE MODEL 4157-03

Table 6-12. EMR - TELEMETRY

PARTS LIST 27645 REV DATE 01/20/77 REV LTR B

LIST TITLE PWA,LPOF OUT AMPL 7POLE CHGE CONT NO. CODE IDENT SHT 1 OF 3
PART NO. 205-89-01519 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USE
1	1	204-89-00491	27644	PWB,LPOF OUT AMPL 7POLE	EMR	204-89-00491	
2	13	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	AR	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	
5	AR	287-02-00002		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	1	049-98-00010		CLIP,THERMAL EQUALIZING	WAKEFIELD	259-18-25	
10	9	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
11	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
12	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
13	2	189-98-00011		PAD,XSTR,TO-5 8PIN,.075H	MILTON ROSS	10193-DAP	
14	3	273-98-00035		WASHER,#8,FIBRE .175ID	SEASTROM	5602-79-062	
15	AR	060-11-00010		CMPD,ADHESIVE,FAST SET	EASTMAN	910	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 3	1	999-01-00011	27655	CAP.,*FVAR*			
C 4	1	999-01-00012	27655	CAP.,*FVAR*			
C 5	1	301-03-22000		CAP.,2200PF 20% 50V	MML 48	8111-050-651-222M/MML	
C 6	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 7	1	999-01-00013	27655	CAP.,*FVAR*			
C 8	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	1	999-01-00014	27655	CAP.,*FVAR*			
C 11	1	000-00-00000	600	CAP.,*TVAR*DM15/DM19			
C 13 THRU C 15	3	999-01-00016	27655	CAP.,*FVAR*			
C 16	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 17	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 18	1	304-08-02009	600	CAP.,20PF .5PF 500V	EMR	304-08-02009	
C 20	1	999-01-00016	27655	CAP.,*FVAR*			
C 21	1	999-01-00018	27655	CAP,*FVAR*			
C 23	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 24	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 12A	1	999-01-00015	27655	CAP.,*FVAR*			
C 22A	1	999-01-00027	27655	CAP,*FVAR*			
CR 3	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 4	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 5	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 6	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 7	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 8	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 9	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	

FIRST USAGE MODEL 4157-05

Table 6-12 (Cont'd.).

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
L 1 THRU L 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
Q 6	1	263-35-00039		XSTR,NPN,MAT.PR,VBE1-VBE2	AMPEREX	A642/S	
Q 7	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 8	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 9	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 10	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 11	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 12	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	608-09-61900	624	RES. 6.19K 1% 1/10W	EMR	608-09-61900	* P
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 5	1	616-02-11009		RES,110 OHM 5% 1/4W	ALLEN BRAD	RC07GF111J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 8	1	999-01-00001	27655	RES.,*FVAR*			
R 9	1	999-01-00002	27655	RES.,*FVAR*			
R 10	1	999-01-00003	27655	RES.,*FVAR*			
R 11	1	999-01-00004	27655	RES.,*FVAR*			
R 12	1	999-01-00005	27655	RES.,*FVAR*			
R 13	1	999-01-00006	27655	RES.,*FVAR*			
R 14	1	999-01-00007	27655	RES.,*FVAR*			
R 15	1	999-01-00008	27655	RES.,*FVAR*			
R 16	1	999-01-00009	27655	RES.,*FVAR*			
R 17	1	999-01-00010	27655	RES.,*FVAR*			
R 18	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801	* P
R 19	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100	* P
R 20	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 21	1	616-02-30009		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J	
R 22	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 23	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 24	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 25	1	608-09-18201	624	RES, 18.2K 1% 1/10W	EMR	608-09-18201	* P
R 26	1	608-09-15800	624	RES. 1.58K 1% 1/10W	EMR	608-09-15800	* P
R 27	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 28	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 29	1	616-02-91000		RES,9.1K 5% 1/4W	ALLEN BRAD	RC07GF912J	
R 30	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 31	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	* P
R 32	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 33	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 34	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 35	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	

FIRST USAGE MODEL 4157-05

Table 6-12 (Cont'd.).

205-89-01519 27645 SHT 3 OF 3

ITEM NO.	QTY REQD	F M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 36	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 37	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 38	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 39	1	201-98-00165		POT,TRMR,1.0 MEG 20% .5W	BECK/MML27	62PR1MEG	* K
R 40	1	999-01-00019	27655	RES.,*FVAR*			
R 42	1	999-01-00021	27655	RES.,*FVAR*			
R 43	1	999-01-00022	27655	RES.,*FVAR*			
R 44	1	999-01-00023	27655	RES.,*FVAR*			
R 46	1	616-02-51003		RES,5.1 MEG 5% 1/4W	ALLEN BRAD	RC07GF515J	
U 1	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
U 2	1	046-34-00004		IC,LIN AMPL,OPNL.	MML 40	LM301AH	
REF 1	1	905-01-01318	27643	SCHEM,PWA,LPOF OUT AMPL	EMR	905-01-01318	
REF 2	1	905-04-00002	9500-1	SPEC,COMPONENT SPACING	EMR	905-04-00002	
REF 3	1	905-05-00372	27655	VAR CHART,MODEL 4157-05	EMR	905-05-00372	
REF 4	1	905-07-00164	15712	SPEC,ENG,MODEL 4157 L.P.	EMR	905-07-00164	

FIRST USAGE MODEL 4157-05

Table 6-13. EMR - TELEMETRY

PARTS LIST 15819-2 REV DATE 01/20/77 REV LTR G

LIST TITLE PWA,7 POLE LPOF CA CHGE CONT NO. CODE IDENT SHT 1 OF 2
PART NO. 205-89-01252 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	204-89-00166	15816	PWB,LPOF,5 POLE	EMR	204-89-00166	
2	13	065-90-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	2	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	* P
5	2	287-02-00002		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	* P
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	1	049-98-00010		CLIP,THERMAL EQUALIZING	WAKEFIELD	259-18-25	
10	9	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
12	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
13	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
14	AR	268-02-00039		TUBING,#22,EXTR TEF,CLEAR	PRCMT OPTION	MIL-I-22129	
15	AR	268-98-00001		TUBING,1/4,THERMO-FIT,WHT	RAYCHEM	RNF-100	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 3	AR	999-01-00001	1975	CAP., *FREQ/VAR*			
C 4	AR	999-01-00002	1975	CAP., *FREQ/VAR*			
C 5	1	301-03-22000		CAP.,2200PF 20% 50V	MML 48	8111-050-651-222M/MML	* Q
C 6	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 7	1	999-01-00011	1975	CAP,*FREQ/VAR*			
C 8	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	AR	999-01-00003	1975	CAP., *FREQ/VAR*			
C 12	1	304-00-00000	600	CAP,*TVAR*			
C 13	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 17	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 18	1	304-08-02009	600	CAP.,20PF .5PF 500V	EMR	304-08-02009	
C 19	1	336-10-68003	601	CAP., 6.8MF 10% 6V	EMR	336-10-68003	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 3	1	088-10-48290		DIODE,STABISTOR,.64-1.25V	JEDEC	1N4829	
CR 4	1	088-10-48290		DIODE,STABISTOR,.64-1.25V	JEDEC	1N4829	
CR 5	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 6	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 7	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 8	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 9	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
FL 1	AR	999-01-00007	1975	FIL, *FREQ/VAR*			
L 1 THRU L 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
Q 1	1	263-10-49470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	

FIRST USAGE MODEL 4157-55

Table 6-13 (Cont'd.).

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
Q 6	1	263-35-00039		XSTR,NPN,MAT.PR,VBE1-VBE2	AMPEREX	A642/S	
Q 7	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 8	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 9	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 10	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 11	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 12	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	608-09-61900	624	RES. 6.19K 1% 1/10W	EMR	608-09-61900	* P
R 2	1	999-01-00008	1975	RES,.*FVAR*			
R 3	1	616-02-10030		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 5	1	616-02-11009		RES,110 OHM 5% 1/4W	ALLEN BRAD	RC07GF111J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	616-02-18006		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 11	AR	999-01-00005	1975	RES, *FREQ/VAR*			
R 12	AR	276-99-00008	619-22	WIRE,#22,BUSS,SOLID	EMR	276-99-00008	
R 15	AR	276-99-00008	619-22	WIRE,#22,BUSS,SOLID	EMR	276-99-00008	
R 17	AR	999-01-00006	1975	RES, *FREQ/VAR*			
R 18	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801	* P
R 19	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100	* P
R 20	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 21	1	616-02-30039		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J	
R 22	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 23	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 24	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 25	1	608-09-18201	624	RES, 18.2K 1% 1/10W	EMR	608-09-18201	* P
R 26	1	608-09-15800	624	RES. 1.58K 1% 1/10W	EMR	608-09-15800	* P
R 27	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 28	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 29	1	616-02-91000		RES,9.1K 5% 1/4W	ALLEN BRAD	RC07GF912J	
R 30	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 31	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	* P
R 32	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 33	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 34	1	999-01-00004	1975	RES,*FVAR*			
R 35	1	616-02-10030		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 36	1	616-02-10030		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 37	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 38	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 39	1	201-98-00268		POT,TRMR, 20 K 10% .5W	BECK/MML27	72PMR20K	* P
R 40	1	999-01-00009	1975	RES,*FVAR*			
R 41	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
U 1	1	999-01-00010	1975	IC,*FVAR*			
REF 1	1	905-01-00321	15817	SCHEMATIC,PWA	EMR	905-01-00321	
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 3	1	905-05-00303	1975	VARIABLE CHART,MODEL 4157	EMR	905-05-00303	
REF 4	1	905-05-00167	14920	VARIABLE CHART,MODEL 4157	EMR	905-05-00167	

FIRST USAGE MODEL 4157-05

Table 6-13 (Cont'd.). 205-89-01252 15819-2 SHT 3 OF 3

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USA
REF 5	1	905-07-00164	15712	SPEC,ENG,MODEL 4157 L.P.	EMR	905-07-00164	

FIRST USAGE MODEL 4157-05

Table 6-14. EMR - TELEMETRY

PARTS LIST 27645-1 REV DATE 01/20/77 REV LTR B

LIST TITLE PWA,LPOF OUT AMPL 7POLE CHGE CONT NO. CODE IDENT SHT 1 OF 2
PART NO. 205-69-01520 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USE
1	1	204-89-00491	27644	PWB,LPOF OUT AMPL 7POLE	EMR	204-89-00491	
2	13	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	AR	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	
5	AR	287-02-00002		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	1	049-98-00010		CLIP,THERMAL EQUALIZING	WAKEFIELD	259-18-25	
10	9	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
11	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
12	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
13	2	189-98-00011		PAD,XSTR,TO-5 8PIN,.075H	MILTON ROSS	10193-DAP	
14	3	273-98-00035		WASHER,#8,FIBRE .175ID	SEASTROM	5602-79-062	
15	AR	060-11-00010		CMPD,ADHESIVE,FAST SET	EASTMAN	910	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 3	1	999-01-00011	27656	CAP.,*FVAR*			
C 4	1	999-01-00012	27656	CAP.,*FVAR*			
C 5	1	301-03-22000		CAP.,2200PF 20% 50V	MML 48	8111-050-651-222M/MML	
C 6	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 7	1	999-01-00013	27656	CAP.,*FVAR*			
C 8	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	1	999-01-00014	27656	CAP.,*FVAR*			
C 11	1	000-00-00000	600	CAP.1*TVAR*DM15/DM19			
C 13 THRU C 15	3	999-01-00016	27656	CAP.,*FVAR*			
C 16	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 17	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 18	1	304-08-02009	600	CAP.,20PF .5PF 500V	EMR	304-08-02009	
C 20	1	999-01-00016	27656	CAP.,*FVAR*			
C 21	1	999-01-00018	27656	CAP.,*FVAR*			
C 23	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 24	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 12A	1	999-01-00015	27656	CAP.,*FVAR*			
C 22A	1	999-01-00027	27656	CAP.,*FVAR*			
CR 3	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 4	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 5	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 6	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 7	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 8	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 9	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	

FIRST USAGE MODEL 4157-06

Table 6-14 (Cont'd.).

205-09-01520 27645-1 SHT 2 OF

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USA
L 1 THRU L 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
Q 6	1	263-35-00039		XSTR,NPN,MAT.PR,VBE1-VBE2	AMPEREX	A642/S	
Q 7	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 8	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 9	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 10	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 11	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 12	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	608-09-61900	624	RES. 6.19K 1% 1/10W	EMR	608-09-61900	
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 5	1	616-02-11009		RES,110 OHM 5% 1/4W	ALLEN BRAD	RC07GF111J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 8	1	999-01-00001	27656	RES.,*FVAR*			
R 9	1	999-01-00002	27656	RES.,*FVAR*			
R 10	1	999-01-00003	27656	RES.,*FVAR*			
R 11	1	999-01-00004	27656	RES.,*FVAR*			
R 12	1	999-01-00005	27656	RES.,*FVAR*			
R 13	1	999-01-00006	27656	RES.,*FVAR*			
R 14	1	999-01-00007	27656	RES.,*FVAR*			
R 15	1	999-01-00008	27656	RES.,*FVAR*			
R 16	1	999-01-00009	27656	RES.,*FVAR*			
R 17	1	999-01-00010	27656	RES.,*FVAR*			
R 18	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801	
R 19	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100	
R 20	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 21	1	616-02-30039		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J	
R 22	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 23	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 24	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 25	1	608-09-18201	624	RES, 18.2K 1% 1/10W	EMR	608-09-18201	
R 26	1	608-09-15800	624	RES. 1.58K 1% 1/10W	EMR	608-09-15800	
R 27	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 28	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 29	1	616-02-91200		RES,9.1K 5% 1/4W	ALLEN BRAD	RC07GF912J	
R 30	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	
R 31	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 32	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 33	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	
R 34	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 35	1	616-02-10030		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	

FIRST USAGE MODEL 4157-06

Table 6-14 (Cont'd.). 205-09-01520 27645-1 SHT 3 OF 3

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 36	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 37	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 38	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 39	1	201-98-00165		POT,TRMR,1.0 MEG 20% .5W	BECK/MML27	62PR1MEG	* K
R 40	1	999-01-00019	27656	RES.,*EVAR*			
R 42	1	999-01-00021	27656	RES.,*EVAR*			
R 43	1	999-01-00022	27656	RES.,*EVAR*			
R 44	1	999-01-00023	27656	RES.,*EVAR*			
R 46	1	616-02-51003		RES,5.1 MEG 5% 1/4W	ALLEN BRAD	RC07GF515J	
U 1	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
U 2	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
REF 1	1	905-01-01318	27643	SCHEM,PWA,LPOF OUT AMPL	EMR	905-01-01318	
REF 2	1	905-04-00002	9500-1	SPEC,COMPONENT SPACING	EMR	905-04-00002	
REF 3	1	905-05-00373	27656	VAR CHART,MODEL 4157-06	EMR	905-05-00373	
REF 4	1	905-07-00164	15712	SPEC,ENG,MODEL 4157 L.P.	EMR	905-07-00164	

FIRST USAGE MODEL 4157-06

Table 6-15.

E M R - T E L E M E T R Y

PARTS LIST 15819-3 REV DATE 01/20/77 REV LTR F

LIST TITLE PWA,7 POLE LPOF CD CHGE CONT NO. CODE IDENT SHT 1 OF 3
PART NO. 205-89-01253 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	204-89-00166	15818	PWB,LPOF,5 POLE	EMR	204-89-00166	
2	13	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	2	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	* .
5	2	287-02-00002		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	* P
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	1	049-98-00010		CLIP,THERMAL EQUALIZING	WAKEFIELD	259-18-25	
10	9	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
12	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
13	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
14	AR	268-02-00039		TUBING,#22,EXTR TEF,CLEAR	PRCMT OPTION	MIL-I-22129	
15	AR	268-98-00001		TUBING,1/4,THERMO-FIT,WHT	RAYCHEM	RNF-100	
C 1	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 2	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 3	AR	999-01-00001	1976	CAP., *FREQ/VAR*			
C 4	AR	999-01-00002	1976	CAP., *FREQ/VAR*			
C 5	1	301-03-22000		CAP.,2200PF 20% 50V	MML 48	8111-050-651-222M/MML	* .
C 6	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 7	1	999-01-00011	1976	CAP,*FREQ/VAR*			
C 8	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 9	1	301-13-10002		CAP, .1UF 20% 50V LS.200	MML 48	8131-050-651-104M/MML	
C 10	AR	999-01-00003	1976	CAP., *FREQ/VAR*			
C 12	1	304-00-00006	600	CAP,*TVAR*			
C 16	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 17	1	304-20-10009	600	CAP. 100PF 1% 500V	EMR	304-20-10009	
C 18	1	304-08-02009	600	CAP.,20PF .5PF 500V	EMR	304-08-02009	
C 19	1	336-10-68003	601	CAP., 6.8MF 10% 6V	EMR	336-10-68003	
CR 1	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 3	1	088-10-48200		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 4	1	088-10-49290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 5	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 6	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 7	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 8	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 9	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
FL 1	AR	999-01-00007	1976	FIL, *FREQ/VAR*			
L 1 THRU L 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001	
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	

FIRST USAGE MODEL 4157-06

Table 6-15 (Cont'd.).

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
Q 6	1	263-35-00039		XSTR,NPN,MAT.PR,VBE1-VBE2	AMPEREX	A642/S	
Q 7	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 8	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 9	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 10	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	MML 4	2N3251/2N3251A	
Q 11	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918	
Q 12	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921	
R 1	1	608-09-61900	624	RES. 6.19K 1% 1/10W	EMR	608-09-61900	* P
R 2	1	999-01-00008	1976	RES,*FVAR*			
R 3	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 4	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 5	1	616-02-11009		RES,110 OHM 5% 1/4W	ALLEN BRAD	RC07GF111J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 11	AR	999-01-00005	1976	RES, *FREQ/VAR*			
R 12	AR	276-99-00008	619-22	WIRE,#22,BUSS,SOLID	EMR	276-99-00008	
R 15	AR	276-99-00008	619-22	WIRE,#22,BUSS,SOLID	EMR	276-99-00008	
R 17	AR	999-01-00006	1976	RES, *FREQ/VAR*			
R 18	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801	* P
R 19	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100	* P
R 20	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 21	1	616-02-30009		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J	
R 22	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 23	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 24	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 25	1	608-09-18201	624	RES, 18.2K 1% 1/10W	EMR	608-09-18201	* P
R 26	1	608-09-15800	624	RES. 1.58K 1% 1/10W	EMR	608-09-15800	* P
R 27	1	616-02-04709		RES,47 OHM 5% 1/4W	ALLEN BRAD	RC07GF470J	
R 28	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J	
R 29	1	616-02-91909		RES,9.1K 5% 1/4W	ALLEN BRAD	RC07GF912J	
R 30	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 31	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	* P
R 32	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309	
R 33	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400	* P
R 34	1	999-01-00004	1976	RES,*FVAR*			
R 35	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 36	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 37	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J	
R 38	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J	
R 39	1	291-98-00268		POT,TRMR, 20 K 10% .5W	BECK/MML27	72PMR20K	* P
R 40	1	999-01-00009	1976	RES,*FVAR*			
R 41	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
U 1	1	999-01-00010	1976	IC,*FVAR*			
REF 1	1	905-01-00321	15817	SCHEMATIC,PWA	EMR	905-01-00321	
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 3	1	905-05-00304	1976	VARIABLE CHART,MODEL 4157	EMR	905-05-00304	
REF 4	1	905-05-00167	14520	VARIABLE CHART,MODEL 4157	EMR	905-05-00167	

FIRST USAGE MODEL 4157-06

Table 6-15 (Cont'd.). 205-89-01253 15819-3 SHT 3 OF 3

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
REF 5	1	905-07-00164	15712	SPEC,ENG,MODEL 4157 L.P.	EMR	905-07-00164	
			FIRST USAGE MODEL 4157-06				

Table 6-16. EMR - TELEMETRY

PARTS LIST 23357 REV DATE 01/20/77 REV LTR F

LIST TITLE PWA,DUAL SWITCHABLE LPOF CHGE CONT NO. CODE IDENT SHT 1 OF 2
PART NO. 205-89-01289 ECO 54273 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
1	1	204-89-00456	23356	PWB,DUAL SWITCHABLE LPOF	EMR	204-89-00456	
2	13	065-98-00012		CONT,PCB MOUNT RECEPTACLE	AMP	85861-4	
3	1	298-99-00013	15816	HTSK	EMR	298-99-00013	
4	AR	229-02-00076		SCREW,4-40X7/16 PAN HD	PRCMT OPTION	MS51957-16	* P
5	AR	287-02-00032		NUT,HEX, 4-40	PRCMT OPTION	MS35649-244	
6	AR	229-02-00065		SCREW,2-56X1/4 PAN HD	PRCMT OPTION	MS51957-3	* P
7	AR	273-02-00003		WASHER,#2, FLT ST STL	PRCMT OPTION	MS15795-802	
8	AR	060-11-00002		CMPD,LOCKING,FINE THREAD	LOCTITE CORP	LOCTITE GRADE H	
9	AR	060-21-00001		CMPD,DIELECTRIC GEL	DOW CORNING	DOW CORNING 3	
10	1	412-99-00006	15719	IDENT	EMR	412-99-00006	
11	6	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*	DEL BLINN	100-000-NY	
12	3	189-98-00011		PAD,XSTR,TO-5 8PIN,.075H	MILTON ROSS	10193-DAP	
13	AR	255-98-00142		TERM.,MICRO-CLIP,PUSH-IN	VECTOR ELECT	T42-1	
14	AR	276-98-00102		WIRE,#24,STRD,WHT,600V	MML42	NAS-703-24-U-C-9	
15	AR	268-02-00028		TUBING,#20,EXTR TEF,CLR	PRCMT OPTION	MIL-I-22129	
16	3	273-98-00035		WASHER,#8,FIBRE .175ID	SEASTROM	5602-79-062	
17	AR	060-11-00010		CMPD,ADHESIVE,FAST SET	EASTMAN	910	
C 1	1	999-01-00001	23361	CAP,*F/VAR*			
C 2	1	999-01-00002	23361	CAP,*F/VAR*			
C 3	1	999-01-00003	23361	CAP,*F/VAR*			
C 4	1	999-01-00004	23361	CAP,*F/VAR*			
C 5	1	999-01-00005	23361	CAP,*F/VAR*			
C 6	1	999-01-00006	23361	CAP,*F/VAR*			
C 7	1	999-01-00007	23361	CAP,*F/VAR*			
C 8	1	999-01-00008	23361	CAP,*F/VAR*			
C 9	1	999-01-00009	23361	CAP,*F/VAR*			
C 10	1	999-01-00010	23361	CAP,*F/VAR*			
C 11	1	999-01-00011	23361	CAP,*F/VAR*			
C 13	1	999-01-00013	23361	CAP,*F/VAR*			
C 14 THRU C 20	7	341-13-10002		CAP, .1UF 20% 50V LS.200	MML 46	8131-050-651-104M/MML	
C 21	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 22	1	337-14-68003	601	CAP. 6.8MF 10% 35V	EMR	337-14-68003	
C 12A	1	999-01-00012	23361	CAP,*FVAR*			
C 12B	1	304-00-00000	600	CAP,*TVAR*			
CR 1 THRU CR 3	3	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA	JEDEC	1N4148	
CR 4	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 5	1	088-10-48290		DIODE,STABISTOR,.84-1.25V	JEDEC	1N4829	
CR 6	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 7	1	088-99-00339	642-03	DIODE,ZENER 0.4W 4.3V	EMR	088-99-00339	
CR 8	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	
CR 9	1	088-99-00169	663	DIODE,STABISTOR,IF .64V	EMR	088-99-00169	

FIRST USAGE MODEL 4157-07

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER
L 1 THRU 3	3	055-89-00001	956-1306	L,ASSY	EMR	055-89-00001
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947
Q 2	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	NML 4	2N3251/2N3251A
Q 3	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V	NML 4	2N3251/2N3251A
Q 4	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947
Q 5	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921
Q 6	1	263-10-49210		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4921
Q 7	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918
Q 8	1	263-10-49180		XSTR SW-AMP 40V 1A 30W	JEDEC	2N4918
Q 9	1	263-10-43920		XSTR,SI FET,N CHAN,SWITCH	JEDEC	2N4392
Q 10	1	263-10-43920		XSTR,SI FET,N CHAN,SWITCH	JEDEC	2N4392
R 1	1	999-01-00014	23361	RES, *F/VAR*		
R 2	1	999-01-00015	23361	RES, *F/VAR*		
R 3	1	999-01-00016	23361	RES, *F/VAR*		
R 4	1	999-01-00017	23361	RES, *F/VAR*		
R 5	1	999-01-00018	23361	RES, *F/VAR*		
R 7	1	999-01-00019	23361	RES, *F/VAR*		
R 8	1	999-01-00020	23361	RES, *F/VAR*		
R 9	1	999-01-00021	23361	RES, *F/VAR*		
R 10	1	999-01-00022	23361	RES, *F/VAR*		
R 11	1	999-01-00023	23361	RES, *F/VAR*		
R 12	1	999-01-00024	23361	RES, *F/VAR*		
R 13	1	616-02-22001		RES,22K 5% 1/4W	ALLEN BRAD	RC07GF223J
R 14	1	999-01-00033	23361	RES, *F/VAR*		
R 15	1	616-02-10003		RES,1 MEG 5% 1/4W	ALLEN BRAD	RC07GF105J
R 16	1	616-02-22001		RES,22K 5% 1/4W	ALLEN BRAD	RC07GF223J
R 17	1	616-02-22001		RES,22K 5% 1/4W	ALLEN BRAD	RC07GF223J
R 18	1	999-01-00034	23361	RES, *F/VAR*		
R 19	1	999-01-00035	23361	RES, *F/VAR*		
R 20	1	999-01-00025	23361	POT, *F/VAR*		
R 22	1	608-09-19100	624	RES, 1.91K 1% 1/10W	EMR	608-09-19100
R 23	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400
R 24	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309
R 25	1	608-09-14309	624	RES, 143.0 OHM 1% 1/10W	EMR	608-09-14309
R 26	1	608-09-12400	624	RES, 1.24K 1% 1/10W	EMR	608-09-12400
R 27	1	608-09-11801	624	RES, 11.8K 1% 1/10W	EMR	608-09-11801
R 28	1	616-02-33000		RES,3.3K 5% 1/4W	ALLEN BRAD	RC07GF332J
R 29	1	616-02-15009		RES,150 OHM 5% 1/4W	ALLEN BRAD	RC07GF151J
R 30	1	616-02-15009		RES,150 OHM 5% 1/4W	ALLEN BRAD	RC07GF151J
R 31	1	616-02-33000		RES,3.3K 5% 1/4W	ALLEN BRAD	RC07GF332J
R 32	1	616-02-30009		RES. 300 OHM 5% 1/4W	ALLEN BRAD	RC07GF301J
R 33	1	623-02-02409		RES, 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J
R 34	1	623-02-02409		RES. 24 OHM 5% 1W	ALLEN BRAD	RC32GF240J
R 35	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J
R 36	1	616-02-01009		RES,10 OHM 5% 1/4W	ALLEN BRAD	RC07GF100J
R 37	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J
R 38	1	616-02-18000		RES,1.8K 5% 1/4W	ALLEN BRAD	RC07GF182J

FIRST USAGE MODEL 4157-07

Table 6-16 (Cont'd.). 205-89-01289 23357 SHT 3 OF

ITEM NO.	QTY REQD	F M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAGE
R 39	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 40	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 41	1	616-02-10003		RES,1 MEG 5% 1/4W	ALLEN BRAD	RC07GF105J	
R 42	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 43	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 44	1	999-01-00026	23361	RES, *F/VAR*			
R 45	1	999-01-00027	23361	RES, *F/VAR*			
R 46	1	999-01-00028	23361	RES, *F/VAR*			
R 47	1	999-01-00029	23361	RES, *F/VAR*			
R 48	1	999-01-00036	23361	RES, *F/VAR*			
U 1	1	999-01-00030	23361	IC, *F/VAR*			
U 2	1	999-01-00031	23361	IC, *F/VAR*			
U 3	1	999-01-00032	23361	IC, *F/VAR*			
U 4	1	046-15-00003		IC,ARRAY XSTR,3G1DIFF PR	RCA/HML40	CA3045 OR CA3046	
REF 1	1	905-01-00925	23355	SCHEMATIC,PWA,SWCHBL LPOF	EMR	905-01-00925	
REF 2	1	905-05-00312	23361	VARIABLE CHART,MOD4157-07	EMR	905-05-00312	
REF 3	1	905-07-00235	23365	SPEC,ENGRG,MODEL 4157-07	EMR	905-07-00235	
REF 4	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	

FIRST USAGE MODEL 4157-07

PARTS LIST 15807
LIST TITLE PWA,REGULATOR
PART NO. 205-89-00377

REV DATE 01/09/78 REV LTR H
CHGE CONT NO. CODE IDENT SHT 1 OF 2
ECO 55781 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION
1	1	214-89-00163	15806	PWB,REGULATOR
2	6	189-98-00004		PAD,XSTR 4 PIN*USE OPTL*
3	11	165-98-00012		CONT,PCB MOUNT RECEPTACLE
C 2	1	354-63-50005		CAP., 500MF -10&75% 40V
C 3	1	336-14-10003	601	CAP. 1.0MF 10% 35V
C 4	1	336-14-10003	601	CAP. 1.0MF 10% 35V
C 5	1	354-63-50005		CAP., 500MF -10&75% 40V
C 6	1	337-14-68003	601	CAP. 6.8MF 10% 35V
C 7	1	337-14-68003	601	CAP. 6.8MF 10% 35V
C 8	1	301-03-10001		CAP,CR , 50V .010 UF 20%
CR 1	1	301-03-10001		CAP,CR , 50V .010 UF 20%
CR 2	1	214-98-00003		RECT,BRDG FW, 1.0A,100V
CR 3	1	088-10-41480		DIODE,SW,75V/5UA,4NS/10MA
CR 4	1	088-10-40020		DIODE,RECTIFIER 100V,1A,I
CR 5	1	088-10-09360		DIODE,REF,9V/7.5MA,.005 %
CR 6	1	088-10-40020		DIODE,REF,9V/7.5MA,.005 %
CR 7	1	088-10-41480		DIODE,RECTIFIER 100V,1A,I
Q 1	1	263-97-00093		DIODE,SW,75V/5UA,4NS/10MA
Q 2	1	263-10-39470		XSTR,PNP,SWITCH/AMPL,50V
Q 3	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE
Q 4	1	263-97-00093		XSTR,NPN 40V SW-AMPL,HFE
Q 5	1	263-10-39470		XSTR,PNP,SWITCH/AMPL,50V
Q 6	1	263-97-00093		XSTR,PNP,SWITCH/AMPL,50V
R 1	1	616-09-10001	624	XSTR,NPN 40V SW-AMPL,HFE
R 3	1	616-09-10001	624	RES,10K 5% 1/4W
R 4	1	616-02-10001		RES. 10K 1% 1/10W
R 5	1	616-02-15000		RES,10K 5% 1/4W
R 6	1	616-02-10004		RES,1.5K 5% 1/4W
R 7	1	616-02-20000		RES,10 MEG 5% 1/4W
R 8	1	616-02-91000		RES,2K 5% 1/4W
R 9	1	616-09-00001	624	RES,9.1K 5% 1/4W
R 10	1	616-02-00000		RES, *T/VAR* 1% 1/10W
R 11	1	616-02-20000		RES, *T/VAR* 5% 1/4W
R 12	1	616-02-91000		RES,2K 5% 1/4W
R 13	1	616-09-00001	624	RES,9.1K 5% 1/4W
R 14	1	616-02-00000		RES, *T/VAR* 1% 1/10W
R 15	1	616-02-10001		RES, *T/VAR* 5% 1/4W
R 16	1	616-02-15000		RES,10K 5% 1/4W
R 17	1	616-02-10004		RES,1.5K 5% 1/4W
				RES,10 MEG 5% 1/4W

ITEM NO.	QTY REQD	E M R NUMBER	DRAWING OR SPEC NO.	DESCRIPTION
R 17	1	618-09-10001	624	RES. 10K 1% 1/10W
R 18	1	616-02-10001		RES,10K 5% 1/4W
REF 1	1	905-01-00319	15805	SCHEMATIC,PWA
REF 2	1	905-04-00001	9500	SPEC,COMPONENT SPACING

Table 6-18. EMR - TELEMETRY

PARTS LIST 22244 REV DATE 10/06/77 REV LTR E

LIST TITLE PWA,SIGNAL LOSS CIRCUIT CNGE CONT NO. CODE IDENT SHT 1 OF 1
PART NO. 205-89-01094 ECO 55389 06141 CKD BY

ITEM NO.	QTY REQD	EMR NUMBER	DRAWING OR SPEC NO.	DESCRIPTION	VENDOR NAME	VENDOR PART NUMBER	USAG
1	1	204-89-00415	22243	PWB,SIGNAL LOSS CIRCUIT	EMR	204-89-00415	
C 1	1	336-12-33003	601	CAP., 3.3MF 10% 15V	EMR	336-12-33003	
C 2	1	336-12-33003	601	CAP., 3.3MF 10% 15V	EMR	336-12-33003	
C 3 THRU C 6	4	301-03-10001		CAP., .01MF 20% 50V LS.10	MML 48	8121-050-651-103M/MML	
C 7	1	337-02-33004	601	CAP., 33MF 5% 10V	EMR	337-02-33004	*
C 8	1	301-03-10001		CAP., .01MF 20% 50V LS.10	MML 48	8121-050-651-103M/MML	
C 9	1	301-03-10001		CAP., .01MF 20% 50V LS.10	MML 48	8121-050-651-103M/MML	
CR 1	1	088-10-41480		DIODE,SW,75V/50UA,4NS/10MA	JEDEC	1N4148	
CR 2	1	088-99-00329	642-07	DIODE,ZENER 0.4W 6.2V	EMR	088-99-00329	
CR 3	1	088-99-00119	642-13	DIODE,ZENER 0.4W 12.0V	EMR	088-99-00119	
CR 4	1	088-10-41480		DIODE,SW,75V/50UA,4NS/10MA	JEDEC	1N4148	
Q 1	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 2	1	263-10-39470		XSTR,NPN 40V SW-AMPL,HFE	JEDEC	2N3947	
Q 3	1	263-10-22221		XSTR,NPN 75V,DC/UHF AMPL	MML 4	2N2222A	
Q 4	1	263-10-22221		XSTR,NPN 75V,DC/UHF AMPL	MML 4	2N2222A	
R 1	1	616-02-10091		RES,10K 5% 1/4W	ALLEN BRAD	RC07GF103J	
R 2	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 3	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 4	1	616-02-00279		RES, 2.7 OHM 5% 1/4W	ALLEN BRAD	RC07GF2R7J	
R 5	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
R 6	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 7	1	608-09-30100	624	RES. 3.01K 1% 1/10W	EMR	608-09-30109	*
R 8	1	616-02-10001		RES,10K 5% 1/4W	ALLEN BRAD	RC07GF103J	
R 9	1	616-02-30000		RES,3K 5% 1/4W	ALLEN BRAD	RC07GF302J	
R 10	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 11	1	608-09-71501	624	RES. 71.5K 1% 1/10W	EMR	608-09-71501	*
R 12	1	608-09-10009	624	RES, 100.0 OHM 1% 1/10W	EMR	608-09-10009	*
R 13	1	608-01-33202	624	RES, 332K 1% 1/10W 100 PP	EMR	608-01-33202	
R 14	1	616-02-12000		RES,1.2K 5% 1/4W	ALLEN BRAD	RC07GF122J	
R 15	1	616-02-10000		RES,1K 5% 1/4W	ALLEN BRAD	RC07GF102J	
R 16	1	201-98-00093		POT,TRMR, 5.0 K 10% .5W	BECK/MML27	62PR5K	*
R 17	1	608-01-00000	624	RES,*T/VAR*			
R 18	1	616-02-10009		RES,100 OHM 5% 1/4W	ALLEN BRAD	RC07GF101J	
R 19	1	616-02-39000		RES,3.9K 5% 1/4W	ALLEN BRAD	RC07GF392J	
U 1	1	046-97-00207		IC,LIN COMPTR,DIFF HS	FCH/MML40	710HM	
U 2	1	046-34-00004		IC,LIN AMPL,OPNL	MML 40	LM301AH	
REF 1	1	905-04-00001	9500	SPEC,COMPONENT SPACING	EMR	905-04-00001	
REF 2	1	905-01-00777	22242	SCHEMATIC,PWA,SIG LOSS	EMR	905-01-00777	

FIRST USAGE MODEL 4150-M9

Table 6-19. EMR 4150-02 Recommended Spares List

ITEM NO.	PART DESCRIPTION	EMR NUMBER	RS	PRICE
001	JACK, TEST POINT WHITE	143-98-00006	1	
002	CAPACITOR, 0.02μf 20% 1000V	301-76-20001	1	
003	FUSE, MICRO, 1/2 AMP 125V	120-98-00037	1 BOX	
004	POT, 500 OHM 10%, .75W	201-98-00247	1	
005	XSTR, SW-AMP 40V 1A 30W	263-10-49180	1	
006	XSTR. SW-AMP 40V 1A 30W	263-10-49210	1	
007	CAP, .02μf 20% 1000V	301-76-20001	1	
008	POT, 5K 30% 1/2W	201-98-00093	1	
009	PWA, REGULATOR (Spare only if MTTR of 30 minutes is required).	205-89-00377	1	
010	DIODE, REF, 9V/7.5 MA, .005%	088-10-09360	1	
011	DIODE, RECTIFIER, 100V, 1A	088-10-40020	1	
012	DIODE, SW, 75V/5UA, 4NS/10MA	088-10-41480	1	
013	DIODE, STABISTOR, 1.52-1.78	088-97-00001	1	
014	RECTIFIER, MDA 920A-3	214-98-00003	1	
015	XSTR, NPN, 40V, SW-AMPL	263-10-39470	1	
016	XSTR, PNP, SWITCH/AMPL 50V	263-97-00093	1	
017	CAP, 500μf -10% 40V +75%	354-63-50005	1	

Table 6-20. EMR Model 4151 Channel Selector Recommended Spares List

ITEM NO.	PART DESCRIPTION	EMR NUMBER	RS	PRICE
001	IC, DIFF COMPARATOR	046-97-00138	1	
002	IC, OPNL AMPL 18V	046-34-00004	1	
003	IC, ASSY, FOLLOWER, NPN	046-89-00009	1	
004	DIODE, REF, 9V/7.5 MA, .005%	088-10-09360	1	
005	DIODE, SW, 75V/5UA, 4NS/10 MA	088-10-41480	1	
006	DIODE, STABISTOR, 30V/100UA	088-10-48300	1	
007	DIODE, REF, 6.2V/7.5 MA	088-97-08230	1	
008	DIODE, 1N759A, ZENER , 12V	088-99-00119	1	
009	DIODE, 1N756A, ZENER, 8.2V	088-99-00209	1	
010	DIODE, 1N753A, ZENER, 6.2V	088-99-00329	1	
011	DIODE, 1N757A, ZENER, 9.1V	088-99-00379	1	
012	XSTR, NPN, 40MHz, 30V, AMPL	263-10-35650	1	
013	XSTR, NPN, 40V, 300 MA, SW	263-10-36460	1	
014	XSTR, NPN, 40V, SW-AMPL, HFE	263-10-39470	1	
015	XSTR, PNP, 40V, SW-RF AMPL	263-10-41210	1	
016	XSTR, PNP, SWITCH/AMPL, 30V	263-97-49170	1	
017	XSTR, NPN, 20V, SW, 350 MHz	263-99-00099	1	

Filters Recommended Spares List (Including Models 4157-05 and 4157-06 for frequencies >500 Hz)

ITEM NO.	PART DESCRIPTION	EMR NUMBER	RS	PRICE
001	IC, AMPLIFIER	046-89-00002	1	
002	DIODE, SW, 75V/5UA, 4NS/10 MA	088-10-41480	1	
003	DIODE, STABISTOR, .84-1.25V	088-10-48290	1	
004	DIODE, STABISTOR, IF, .64V	088-99-00169	1	
005	DIODE, 1N749A, ZENER, 4.3V	088-99-00339	1	
006	POT, 50 OHM 30% 1/2W	201-98-00068	1	
007	XSTR, NPN 40V SW-AMPL, HFE	263-10-39470	1	
008	XSTR, SW-AMP, 40V, 1A, 30W	263-10-49180	1	
009	XSTR, SW-AMP, 40V, 1A, 30W	263-10-49210	1	
010	XSTR, NPN-MAT. PR, VBE1-VBE2	263-35-00039	1	
011	XSTR, PNP, SWITCH/AMPL 50V	263-99-00139	1	

Table 6-22. EMR Models 4157-05 and 4157-06 Low-Pass Output Filter Recommended Spares List (for frequencies ≤500 Hz)

ITEM NO.	PART DESCRIPTION	EMR NUMBER	RS	PRICE
001	IC, OPNL AMPL, .18V	046-34-00004	1	
002	DIODE, SW, 75V/5UA, 4NS/1DMA	088-10-41480	1	
003	DIODE, STABISTOR, .84-1.25V	088-10-48290	1	
004	DIODE, STABISTOR, IF .64V	088-99-00169	1	
005	DIODE, 1N749A, ZENER, 4.3V	088-99-00339	1	
006	POT, 1MEG 30%, 1/2W	201-98-00165	1	
007	XSTR, PNP, SWITCH/AMP, 50V	263-97-00093	1	
008	XSTR, NPN, 40V, SW-AMPL, HFE	263-10-39470	1	
009	XSTR, SW-AMP, 40V, 1A, 30W	263-10-49180	1	
010	XSTR, SW-AMP, 40V, 1A, 30W	263-10-49210	1	
011	XSTR, NPN, MAT, PR, VBE1-VBE2	263-35-00039	1	

Table 6-23. EMR Model 4157-07 Low-Pass Output Filter
Recommended Spares List

ITEM NO.	PART DESCRIPTION	EMR NUMBER	RS	PRICE
001	IC, 3XSTR AND 1 DIFF	046-15-00003	1	
002	DIODE, SW, 75V/.5UA, 4NS/10MA	088-10-41480	1	
003	DIODE, STABISTOR, .84-1.25V	088-10-48290	1	
004	DIODE, STABISTOR, IF, .64V	088-99-00169	1	
005	DIODE, 1N749A, ZENER, 4.3V	088-99-00339	1	
006	XSTR, PNP, SWITCH/AMPL, 50V	263-97-00093	1	
007	XSTR, NPN, 40V, SW-AMPL, HFE	263-10-39470	1	
008	XSTR, SI, FET, N-CHAN, SWITCH	263-10-43920	1	
009	XSTR, SW-AMP, 40V, 1A, 30W	263-10-49180	1	
010	XSTR, SW-AMP, 40V, 1A, 30W	263-10-49210	1	

Table 6-24. Signal Loss Card Recommended Spares List

ITEM NO.	PART DESCRIPTION	EMR NUMBER	RS	PRICE
001	IC, DIFF COMPTR, GAIN 1250	046-18-00014	1	
002	IC, OPNL AMPL, 18V	046-34-00004	1	
003	DIODE, SW, 75V/5UA, 4NS/10MA	088-10-41480	1	
004	DIODE, 1N759A, ZENER, 12V	088-99-00119	1	
005	DIODE, 1N753A, ZENER, 6.2V	088-99-00329	1	
006	POT, 5K, 30%, 1/2W	201-98-00093	1	
007	XSTR, NPN, 75V, DC/UHF AMPL	263-10-22221	1	
008	XSTR, NPN, 40V, SW-AMPL, HFE	263-10-39470	1	
009	CAP, 01µf $^{-20\%}_{+80\%}$, 100V	301-71-10001	1	
010	CAP, 3.3µf 10%, 15V	336-12-33003	1	
011	CAP, 33µf 5%, 10V	337-02-33004	1	

Table 6-25. Customer Provisioning Questionnaire

1.	Equipment to be spared Model No.(s):_____ Serial No.(s):_____
2.	Number of equipments to be spared in each location_____
3.	Operating time and cycle:_____hours/day,_____days/week.
4.	Operating Environment: A. Temperature:_____ B. Humidity:_____ C. Altitude:_____ D. Shock and Vibration:_____
5.	Non-operating Environment:_____ A. Temperature:_____ B. Humidity:_____ C. Altitude:_____
6.	Desired probability of being able to spare from complement _____percent for_____months.
7.	Can usage permit troubleshooting to parts level when a failure occurs?_____
8.	What spare assemblies do you have that are used in this Model Equipment?_____
9.	Do you wish us to exclude the EMR warranty period?_____

TECHNICAL MANUAL UTILITY REPORT

At EMR, we continuously strive to produce high quality and usable technical manuals for our equipment. To help us in this regard, we request that after reading and using this manual, you record your comments and suggestions on this utility report and return it to EMR. When completed, remove this page from manual, fold on dotted lines, staple, and mail. Insert additional sheets if necessary.

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